David: Today's episode is really fun to listen to. You're going to be inspired and maybe a little bit worried when you're done. We go as deep as what your soil is doing to you. The prospects of living forever, deep research on cancer and how your cells work and all sorts of cool things that are happening in the world around us. I was really inspired and intrigued and a little bit worried by the end of this episode. You're going to love listening to the whole thing.

You're listening to Bulletproof Radio with Dave Asprey.

Today's cool fact of the day is that scientists have figured out that we might be able to live longer by inhibiting a really common enzyme in the body. There's an enzyme called RNA polymerase III or Pol III that's present in all animal species, even worms. At the University College London's Institute for Healthy Aging, they found that lifespans in worms, flies, and yeast went up 10% when they suppressed that enzyme but only in adults. The doctor who led the study says, "There's a lot of hyper on drugs that expand lifespan and promote healthy aging but very little is known about how they work, which is fundamental knowledge."

One of the things I like to do here on Bulletproof Radio is share some of this new knowledge and have this idea that what if you took a whole bunch of these things that I'll add only 10, 20, 30% to your lifespan and you just stacked them all up, with some basic knowledge, even if we're not sure but at least directional knowledge about what they do and how we think they work, your odds of not dying of old age probably go up.

I think that that combination of things, along with careful monitoring and not being hit by falling pianos from the sky and things like that, it ought to let me make it at least to 180. I'm hoping you'll join me in that quest to live way longer than Mother Nature ever intended and to die at a time and place and by a method of your own choosing.

All right. On that note, let's get going on today's episode. Today's guest is Zach Bush. He's a triple board certified physician and founder and director of M Clinic. He's a real interesting guy because he's certified in endocrinology, metabolism, internal medicine and end-of-life care. Basically, everything that's going on in your hormonal system, your metabolism and even what happens at the very end of your life. That path led him to create something that a lot of my naturopath friends been talking about recently is something called Restore, which is for keeping the lining of the gut intact. We're going to talk about his story, about what's really pulling our guts apart, and what's going on inside your gut, what the environmental factors are and what you can do about it. Zach, welcome to the show.

Zach: Thank you, Dave, for having me. I'm excited to be here.

David: I just first want to say thanks. I know that we rescheduled our show at the last minute. You're in New York. I'm breaking your circadian rhythm right now because it's somewhere around midnight your time. For me, it's only nine o'clock. I'm sitting here wearing my TrueDark Twilight Glasses so I'm looking like a superhero with red laser vision or something but you're just sitting there with this amazingly beautiful studio with

bright lights in your eyes. You're not going to sleep tonight but I am. I just want to say, "Thanks, man."

Zach: I appreciate that.

David: All right. Tell me about your story here where you started looking at plant health versus human health as a doctor. What got you going in this whole thing?

Zach: Yeah. It was a non-linear journey. At the time, I was actually designing chemotherapy. I was working in a laboratory at the University of Virginia and trying to figure out how cancer cells failed to regulate their own death. That's one of the most important functions in human cell longevity is actually knowing when to shut the system down. That's the hallmark of cancer is that they lose the ability to turn themselves off. They are aware they are riddled with injury and accumulation of massive DNA dysfunction. Yet, they can't mount this suicidal approach to allow for themselves to be replaced so that the larger organism, i.e., the human or the animal in which the tumor is occurring is allowed to continue on. That was my area of expertise in the cancer world was mechanisms of action in turning that on.

Turns out that one of the more exciting developments that happened in my career was finding that there was some vitamin A compounds that were enabling these cancer cells to shut themselves down and commit suicide. The implications are pretty big because it means that suddenly, you don't need immune system to overcome cancer. That cancer simply eliminates itself when it realizes it's part of a larger organism.

That was an incredible journey of starting to see cancer not as some disease that crops out of nowhere, not a genetic disease as we're told by the American Cancer Institute and everything but actually just a breakdown in cell-cell communication. It took me about four years of studying all of that before I even made the connection that vitamin A comes from carrots. That journey of thinking, "Oh, my gosh. I wonder if there's something to that whole nutrition thing." Of course, I hadn't taken a single quality course on nutrition in 17 years of academic pursuit.

Then, it took me another four, five years to rebuild that whole belief system around wellness, disease and all of that. Ultimately, in 2010, launched my own clinic that would be trying to push the paradigm of nutrition forward because even to this day, I feel like the vast majority of nutrition that is taught is really in the dark ages of basic science. We really should be much further down this path of understanding the interactions of our human cells with the nutrients that are around us. That was some of that bumpy journey into realizing that perhaps the plant world was important.

David: You mentioned that vitamin A comes from carrots but that's actually more beta-carotene, which isn't really vitamin A that more comes from liver and things like that. What was this amazing plant compound that turned off cancer cells and should we all be eating more of it?

Zach: Yeah. The compounds that you're looking at that are in that carrot and other fruits and vegetables are the retinoids. It's the retinoids that would be then modified into the vitamin A kind of family of categories. They hit a number of receptors in the cell. The most abundant receptor in the human cell is really this RXR receptor. It will bind to vitamin A compound. Then, interesting, has to then go on to bind another receptor of some other hormonal quality before it can then go bind the DNA and do transcription of lots of different things.

The journey was less about vitamin A. It was much more about how does the cell start to gather information and how does the mitochondria then take that information and turn it into fuel because the whole metabolism side of my specialty of endocrinology metabolism, we had been taught that that's all about producing ATP or adenosine triphosphate. That's the only fuel the human cell runs on. We don't run on protein. We don't run on glucose. We don’t run on fat. All of this stuff is actually what bacteria will break down and produce from your food but they have to feed that then to the mitochondria.

This was at a turning point in the mid 2000s when we were starting to realize that the ATP, while real critical for being a fuel source, was not the eloquence of the mitochondria. The eloquence of the mitochondria is actually the metabolites or breakdown products that are produced on the way to ATP. These, as a family, have been come to recognized at redox molecules, which is contraction of reduction and oxidation. Reduction is the donation of an electron. Oxidation is the absorption of said electron. You put those together, you get a redox environment. You literally are creating a liquid circuit board where you've got electrical energy traveling through intracellular environments.

You have to remember, those intracellular environments are extremely protected. These are vastly different than the environment around them. pH is perfect, Osmolality is perfect. All the electrolyte balance is there. We have 1,000 mechanisms that are always checking this environment to keep it perfect largely so that these redox molecule can create the signaling capacity they do.

It's the quantum computer chips that are starting to come out. Super, super, super fast. One quantum computer chip, within about a year and a half, will be able to process as many calculations as all the computers on the entire planet. That's a super fast chip but it has to be in a very special environment. It has to be down near absolute zero. That's exactly like the mitochondria. They produce so much energy and so much information, some 10,000 times the power of the sun, some million fold faster than the information than we pass through our neurons in the brain. We're talking about each of these redox signaling molecules lasting a millionth of a second down to the cell level.

I'm just trying to give you some broad strokes of my paradigm of human biology was starting to break down from the beliefs of these slow mechanisms of Newtonian physics and biology to this really incredible world of quantum physics down at the real fabric level. That fabric level was starting to realize that the cancer world was just a long-term

symptom of a more profound thing that you're so interested in, you've done such an incredible job educating everybody on. This secret of longevity is all about cell-cell communication. A cell with uninterrupted access to information will never disease or die. That's a really compelling idea.

David: It's really interesting. I've started to look at the body as there's a couple different networks but one of the biggest networks is these quadrillion mitochondria that are like the biome in your gut. They're talking to each other all the time. If they can't talk to each other effectively or they can't make energy effectively because the environment is wrong, the way you just described it, what you end up is with cancer or diabetes or heart disease or Alzheimer's or Parkinson's or any of these other things that are taken out 50% of people as they age. It is a communications issue. It's a fundamental hardware issue. Hey, we can hack hardware. We can do that all day long. It's such a big revolution right now. The fact that you've got there from a traditional Western broad-spectrum background as endocrinologist.

I'm just going to say this. I know there are a lot of them listening but the average endocrinologist is the worst person to go to if you have a thyroid disorder or any sort of aging-related testosterone deficiency because they'll just look at you and say, "There's nothing wrong. You're just getting old. Deal with it." I'm like, "Are you kidding me? No. I'm not going to deal with getting old. I'm going to deal with getting younger."

All right. Anyway, I'll get off my high horse there but anyway for you to say what you just said with your background is highly unusual. You're saying you came to this because you were studying cancer networks and cancer cells. After four years, you just came across this. What happened in your career when you started saying these things that are basically hearsay in the world of Western cancer treatment?

Zach: I got a lot of distance, suddenly. I have plenty of room around me. Nobody really wanted to associate. Suddenly, I went from winning every teaching award at both the universities I had been in to maybe four, five people in these large auditoriums that would show up to my talks on health and healing because you throw the word healing into a science talk and everybody runs the other way, thinking that you're some sort of woo-woo artist out there. Maybe some of those crazy California doctors or something like that but it's a really rapid way to lose the attention of scientists who are making their living and creating their world view around chronic disease management.

David: You basically decided you take your hits. You call it like you see it, which takes a certain amount of courage. After you did that, what was the first move you did? Like, "Okay. Now I understand. I have this paradigm. I understand that bacteria in the gut are talking to mitochondria in the body." With that new knowledge, how did you go about doing something with that in your clinic?

Zach: Yeah. At this stage, I hadn't realized at all and I think, as a field, there was no talk about how the bacteria were talking across this spectrum. At this point, redox molecules was really something that was regarded as a mitochondrial event inside the human cells. There was no concept of how the bacteria could possibly be talking inside the cells.

However, there was some interesting rumblings coming from some of those crazy hippy doctors in California. UCSD, UCSF were starting to put out some papers on the microbiome genetics. They were starting look at the genomics of the microbiome. They were finding some remarkable correlations of if this bacteria present, then you're going to get this cancer. If these bacteria are missing, you're going to get this cancer. We were starting to see these correlations between microbiome genomics and human disease outcomes. That was complete poppycock, crazy stuff talking in our belief system around how cancer happened and what it was at a disease process and everything else.

At that point, while correlations were being shown, there's no causative process understood. When I departed academia, I came to the conclusion that I was never going to find an academic institute that was going to let me go down the avenue that I was starting to think I needed to do, which was understanding nutrition at the level of reversing chronic disease.

I started out in rural Virginia. I went to one of the poorest counties in Virginia with the intention of setting something up because I figured with chronic disease epidemics bursting out all over the country, the least interesting thing was to go to something like Santa Barbara and create a plant-based anti-inflammatory, integrative medicine clinic and help Santa Barbara survive. If we're going to actually survive as a species, we're going to have to solve the problem on a pretty global level because the financial weight of carrying 80% of the population very sick is too much for any of us to carry. Really set out in this rural environment. It was a total food desert to think, if we can create a nutrition program here that would really change the paradigm of chronic disease, then, we could crack the code. That was altruistic blue sky vision we had.

When I say, "We," it was just me initially but very quickly, as soon as I opened the door, some really wonderful people started to arrive. Many of them still work with me today. The mission started to draw the right people to it. At that point, I'm a go big or go home kind of guy. We were going really ridiculously extreme on getting these nutrients out of mostly vegetables and fruit, some of the fats, too, from nuts, seeds, etc that we knew were going to support these fundamental processes down to the cell level of the mitochondrial metabolism redox molecules, et cetera. The next thing that happened was, always the best thing that happens really is nothing went as planned. Suddenly, we saw 30, 40% of our population doing exactly what we thought was going to happen. Diabetes was disappearing. Chronic inflammatory, autoimmune disease …

David: Hold on. You gave them some plants? What did you do? You don't get 40% of people better.

Zach: Yeah. We were people like crazy. We went on these high, intense combinations of short and long-term fasting with high-intensity, nutrient-dense diets. Very low protein. Protein tends to stress the liver and everything else. Low protein, high nutrient. Leave calories out of the equation and go for intense nutrient density. A lot of juicing, a lot of fermentation, a lot of stuff. Trying to get nature's processing rather than human processing, so that's …

David: Lots of polyphenols, essentially and …

Zach: Pond, yeah.

David: Were these low fats, basically just vegetable juice was what most of you were doing or were you adding fats in as well?

Zach: Lots of fats in there, too. Every year I've been doing this, I add more fat.

David: Me, too.

Zach: Yeah. Really, the fat sources we were using have a layer of the macadamia nut and the avocado in smoothies and things like that. We were loading this in the …

The thing that really changed my whole world view yet again was the fact that there was 20, 30% of people that were seeming to remind, then quickly plateau and I couldn't get them any better. Then, there was this huge chunk, this 40% or so of my patients that a couple years into this process, I had to come to terms with the fact that they were doing it right because initially when I saw them failing, I just assumed you're just not doing it right. "I told you to do this," and blah, blah. I kept blaming them.

But I started to develop real relationship with these people. In academia, you're never a full-time doctor. You never take full responsibility for anything. I was in a rural clinic 24/7, alone. I had to take full responsibility for these people. The beautiful result of that was real relationship. I was starting to trust these people, these patients of mine more than I trust my colleagues in academia and they became my colleagues. They became like your community that you've built, the biohacking community. My hats off to all of you. You are an inspiration to the world because you guys are really taking responsibility for yourselves, number one, but then you're immediately applying the truths that you're finding into a communication network of your own to create a wave outside of you.

That's what our patients were doing. They were saying, "Look, doc. I want to heal through this process but I'm doing exactly what you said and I am getting worse." They were getting worse. Inflammation markers were going up. All of their hypothalamic signaling going to their entire endocrine system was showing huge signs of increasing stress, not decreasing stress. They just were not behaving like the textbooks.

This was the moment that I went from first paradigm shift into, "Maybe plants are good for us. Maybe plants could reverse disease. Maybe plants could be more powerful than chemotherapy to treat cancer," to the moment where it was like, "I wonder if there's something deeper than the plant," or, "Is there something wrong with the plants that we're feeding? Is there something that's failing in the plant itself that's changed the science that I'm trying to apply from the 1960s and 70s when this science was being done very well."

At that moment, we started to research soil. That changed everything. For thousands of years, the pharmaceutical industry and the herbalism community and Chinese medicine have been looking at the plants. There has been a paucity of research and investigation into the deeper story underneath the plant of where the plant's getting that magic.

David: There you go.

Zach: How does a plant create the phenols? The alkaloids are the most extraordinary story coming out of the plants. Plants don't have mitochondria as we do. They have these little plastid that look like mitochondria. Very interesting little organisms. Bacteria and fungi don't have any of these guys.

We're now going into realms that was really departing from any understanding of the biology I've been trained in. It was forcing us to ask questions we never ask. On page 40 of a white paper on dirt. It was 90-page white paper. A, I'd never seen a 90-page white paper and B, I couldn't believe somebody had cared about dirt enough to write that much in their career in there. Was pouring through this dirt paper.

On page 40 is a huge molecule that on the right side of this, it was in two dimensions but my brain did something really fantastic at that moment. I think my purpose is here. This is why I was born. This is why I did ridiculous journey in academia was just for this moment. The blinders came off. The three-dimensional structure on the right side of that molecule looked like the chemotherapy that I'd been making years previous.

At that moment, just total goose bumps. I think we just found a fundamental truth that's been missing from human biology is that there is medicinal quality to the dirt. There's medicinal quality down there that if we divorce ourselves from it, the plant will never get it. If the plant never gets it, we will never get it. If we never get it, the bacteria will never get it and the mitochondria will never … It's just a quick cascade of, "Oh, my gosh. What did we do to the soil?"

David: I got to just tell you this. One of the reasons I live where I live is I can grow all my own food. The dirt in my garden comes from the bottom of a pond that was on an organic farm for 100 years where all this stuff at. There's a reason I do these things. Yeah, I'm very fortunate I can do that. I also live in a cheap part of the world so I can afford to do it but it all comes down to soil. You break the soil, which is a living organism and everything up from there is going to go down including us because we're soil dependent.

All right. What is this molecule? Everyone listening is like, "How do I go eat some dirt?"

Zach: Yeah. This molecule, it turns out, the second massive goose bump moment was when we figured out that answer because initially, it was just saying, "Well, this is in dirt. It's a major component of really good quality dirt." We were starting to look into that. It looks on one end of it like a young coal. It's a lot of carbon structure. It's a lot of almost crystalloid structure. That's common in organic chemistry in humans and otherwise. The unique stuff on the right side of the stuff was clear that it wasn’t going to work if it was in anything but in the most vibrant living soil.

But long story short, a couple weeks later, I figured out that that was coming from bacteria, that was the closing of the loop because, like I said, my research had been in the mitochondria in these redox molecules that they made to regulate cell longevity, cell

death, regulate cancer, et cetera. We had been studying that but we knew those redox molecules could never exit the cell environment. They last for a millionth of a second in a really quality-controlled environment. There's no way they were going to exit this human cell and go into the adversity of the greater environment and create any communication. This carbon backbone on this molecule and the molecule really has a million different variants. Each species tends to make 10 to 15 versions of this. Each species of bacteria, fungi, et cetera.

In a typical, really healthy soil like it sounds like you have in your garden, you've probably got a couple million variants of this molecule. The issue is that the more complexity you get in the variety of these. They're like snowflakes. That's actually what we call them in the lab is carbon snowflakes. Everybody is familiar with the snowflake, each one looking different from the next. The magic seems to happen when you line up a million different variants and you embed 100 million or a billion different variants of that molecule. You suddenly create a liquid circuit board environment where electrons can travel in a million different directions and once you create literally an intelligent structure that's got a carbon backbone, which means it's going to survive in all kinds of noxious environments. The pH of the soil changes from morning to night, pH in your mouth as you swallow your food, changes from 7.5 to 2.4, back to 8.2 in about 14 inches.

You've got this huge adversity just in pH alone let along the osmolality and everything else, the bacteria and the fungi are going to have to communicate through. With the molecule we found is a carbon backbone molecule that's got redox potential. This whole family of molecules that are turned back on and have that redox or electron exchange capacity, we've termed Terrahydrite. It's a hydrogen act of hydrite molecule from the earth, terra. Terrahydrite is the family of molecules that we've named that is coming from this huge population of bacteria and fungi that should be in your soil.

David: These are humic and fulvic acid, essentially, variants of that?

Zach: Yeah. It's another version of a soil extract. First came Shilajit, then humic acids, then fulvic acids. Shilajit is primarily a huge mineral density. You get a really potent mineral load. The problem with Shilajit is it's profoundly oxidative. Humic acid falls in the same category. Folic acid is all oxidative as well but has less of the oxidative stress that you get from something like Shilajit.

When I say oxidative, it means that it has this huge ability to rip electrons off of other things. It literally is rusting the environment when you put Shilajit or humic acid in the environment. It will suck electrons away from things. Electron potential is literally health. Disease is all positive charge absorption of electrons, loss of electron potential.

What's happened in erroneously and I'll often do this in the nutrition world where we find something like, "Oh, that sounds really good for some part of the bone, like calcium." We've done this at endocrinologists for years. "You should take calcium because your bone's made out of calcium." Of course, if we drink milk and eat cheese and intake all this calcium, we lose bone marrow density.

Again, with Shilajit or humic acid, tons of minerals, enormous load. You think, "Wow! The body's made of minerals. Must need that." If you take concentrated load of minerals, you're going to actually demineralize the teeth. You can lose the enamel right off your teeth if you're constantly taking humic and Shilajit and things like that and you're doing oxidative damage to the kidneys. Through and through from stem to stern, you can do damage with these things.

You move down in fulvic acid. Fulvic acids are much more tiny conglomerations. The Shilajits and the humics are very huge, colloidal structures, tons of mineral content. The fulvic acids have much less of the mineral content. It has a lot more ability to move through tissue planes. It's very mobile in the body. I think fulvic acids are a lot safer than humics and everything else but even the extracts that we take, which are basically fulvic-type compounds that we're pulling out of the soil, even those are very oxidative. They kill kidney tubules on contact. They've pulled electrons across and they don't do redox signaling. They don't do a communication piece of the puzzle for us.

To do that, we bring that back to our labs. We push them through substrates of our catalysts of mineral salts that will get the hydrogen to bond back onto those oxidative compounds. Once you can get the hydrogen-oxygen release again, now you're mimicking soil that's really vibrant. To get this really flowing, we're using really ancient dirt. You mentioned that your garden is full of 100 year old organic dirt.

David: Yeah.

Zach: That gives me goose bumps. That's so fricking cool. The excitement that we have about the science we're doing now is we've gone deeper. The concern is that even 100 years ago, this is … You've beaten some of the big herbicides and pesticides and everything else when you go back 100 years. We can talk more about those in a few minutes there. They're now ubiquitous in our environment.

100 years is a very exciting jump but interestingly, if we look at the fossil record of soil, the soil has been degrading in quality for millions of years. The biggest drop actually happened about 60 million years ago, where we went from these extremely deep topsoil levels that were so rich that we were growing ferns and other plants that would allow something like an Allosaurus or the Brontosaurus to survive on plants alone and support a biological body that is four to five times the largest elephants seen in our time. Their heads were slightly smaller than a horse's head. They weren't capable of taking in massive amounts of volume. They were taking in massive amounts of concentrated nutrients from plants that were growing in soils that we really have never been able to experience in human lifetimes.

When you dive back into the fossil record, 50, 60 million years old, you're getting a soil record, you're getting a biodiversity that is really not probably been seen since then. That's where we're drawing the liquid circuit boards from now. We've got dirt in these fossil layers out in Arizona and the desert that have stayed dry for millions of years now. We've prevented the high levels of herbicide, pesticide dumping that we can get in more rain-drenched areas, especially the Southern United States. In the East here, we

see very high levels of herbicides and pesticides and all this. Found some pristine soil in the fossil state. Pulled that out. We've been working with that.

The excitement … Go ahead.

David: I look at this electrical side of things. For about 15 years, on and off, I've experimented with taking carbon nanospheres, these buckyballs. Even just activated charcoal for thousands of years have some properties like what you're talking about, not the mineral richness but just the ability to help the body electrically, collagen protein helps the body carry electrons throughout the body. Different mechanism, different structure and all that sort of stuff but it seems like a lot of these either ancient or the buckyballs are relatively new in terms of anti-aging to call them carbon 60 or C60 nanospheres.

It seems like we're all circling around the same, the mechanisms for aging. Is there any relationship between these other forms of carbon and the stuff that you're working with? By the way, you talked about Terrahydrite is the name of the stuff but the stuff you make is called Restore. That's the stuff that I'm assuming you're talking about.

Zach: Yeah. Yeah, so the product …

David: product, yeah.

Zach: … that comes out of that is the Restore line. Yeah.

David: Okay. Cool.

Zach: Then, we've got some lines for large animals and even companion pets and stuff like that. Restore is the human side of the equation with the dietary supplements but the Terrahydrite is now being seen to be helpful in all levels of biology through any mammal. We've got lions for pets and large animals in the feed chain and everything else. The reality is, the goose bump moment here for us is that the Terrahydrite family …

Oh! To answer your question first. You're asking about the comparison between C60 and the carbon substrates that we would find in Terrahydrite. Enormously different. T60 is similar to what we think of as graphene in the industrial side of the equation. Very organized structural carbon that's very uniform carbon structure where there's no oxygen or hydrogen binding within it. It acts as a cage, if you will. I think biology-wise, people are saying that maybe they're great for capturing heavy metals and other potential toxins, things like that.

When I see one of the C60 molecules, the first thing I think of is a laser chamber. I think that is very likely if there's benefit from C60 in the body, it's because it creates resonance chambers at the atomic physics level that's allowing you to stay in coherent vibration because we're not really made of molecules. We're actually made of atoms. We are just vibrational beings. I think longevity, we're going to find out, has almost nothing in the end to do with the human cell. We're taking all these supplements to do human cells and then, in the end, we're going to find out, yeah, if the biology's starting

to crap out, we're way downstream of the real problem, which is we are resonating incorrectly. That's the interesting phenomena that I think we're moving towards as a science community.

But in the meantime, we're finding all of these pieces of the biology, which are pretty big levers. I love what you guys are doing in the biohacking thing because you guys keep finding new levers to push on to manipulate the biology back into a coherent and cooperative structure to support that longevity goal.

Different structure here. Instead of having resonance chambers of carbon, it's going to come down to electrical exchange from the release of hydrogen or absorption of hydrogen on the oxygen molecule. It's hanging off the end of the carbon. In this case, I think the primary role of the carbon has nothing to do with resonance chambers or electrical energy. It's simply to keep the molecule self stable because you want to be able to hold that oxygen no matter what acid is going through you, no matter how acid or alkaline the environment, it allows that molecule to travel long distances and keep in touch or the capacity for this oxygen/hydrogen binding.

David: One of the things that stood out to me. I'm in this unusual place where I literally talked to hundreds of doctors and healers and just people who are clinically seeing things and a statistically significant number of them are like, "Dave, you should look at this Restore stuff." I did a little bit of diligence and looked around it. What I'm hearing is people saying things like, "A leaky gut goes away. People get more tolerant of gluten and even things like autism and diabetes and Crohn's and all these things are getting better," which, to me, it leads me to believe instead of looking at a high level, this specific disease, you're looking at a fundamental mechanism that's underlying many different diseases. In my mind, that's usually mitochondria but it's certainly redox signaling is part of mitochondria but there might be something else going on.

You found …

Zach: Wow!

David: … that by giving this molecule to people, at least when doctors give this molecule to people, they're seeing all sorts of just distributed stuff get better. The mechanism action there is what you just described, you think it's essentially helping molecules hold together better when they're doing what they do?

Zach: I think it, in this case, the carbon structure is just holding that single molecule together that's allowing for this communication to do. What we think we have found here and this is going to take the rest of my career to prove out because it's a complete change in our understanding of how human biology happens but that keeps happening in the microscope every day in our labs.

This now dates back almost seven years ago when we starting putting this under microscopes. I was already consuming it because I had some very exciting initial results right in my clinic in myself. We had some objective measures, basically some biohacking

tools similar to what you guys are using. We're seeing almost instantaneous changes. I was taking the compound. We're starting to sell biology experiments. I was starting to reunite with some of my colleagues at the University of Virginia to access some of the capacity for their thought processes around what this thing could potentially do.

But the goose bump moments that were really unfolding at this point was that all my cancer research and before that, all my research in neurobiology, I was really into neurochemistry and the effects of the hormone system on how it does neuroplasticity before my cancer research. Whether we're talking about the brain or we're talking about my diabetes management in the clinic or the cancer, all of that understanding that I had gotten through all my research and intense study and blah, blah, blah was all discovered or learned, if you will, in a sterile Petri dish. We have never studied a human cell when it's in touch with the potential of a communication network that's extra-human. That's what this molecule family suddenly offered is what if the bacteria and fungi are talking and what if they can talk to us, and perhaps more importantly than that, what if they are talking to our mitochondria? That was where all the dots suddenly wind up.

David: How do you believe that conversation happens? Via what signaling pathways?

Zach: Turns out that returns right back to this context of redox signaling or electrical exchange across hydrogen molecules. What we're showing now and this happened almost instantaneously in our labs, when you put it into renal tubular cells for safety trials. When I was developing chemotherapy, same thing. We basically used the gold standard of toxicity. We were using proximal renal tubule cells, which are the canary in the coal mind of the human body, the most sensitive to toxicity.

With the first batches of Restore, we're running it across proximal renal tubule cell just to make sure there wasn't any toxicity so that I could start putting it into my patients. We went for the money because I had no money. I went for 20% concentration of this compound. It means the equivalent of replacing 20% of your blood volume with this liquid.

David: That's a lot.

Zach: You go for a money shot because you got one shot at studying this. That 20% is about the threshold where water, if you replace 20% of your bloodstream with free water, that's when it starts to kill renal tubule cells in particular.

I knew that if we could be as safe as water, then I'd be really confident and we could move forward. We'd put in 20% and something totally bizarre happened on about three different levels but the first thing that was obvious is the cells stopped dying. We expanded the life of renal tubule cells by 15% longer than they'd ever been measured in cell culture. That number, that lifespan of renal tubule cell in culture hadn't changed since 1969.

David: Did you publish those results?

Zach: No. The mitochondrial stuff's not published at all because it's still totally doubted. We could throw in a peer-review journal articles all the time. They're going to say, "Nobody has defined a redox signaling molecule from bacteria." This journey and I've seen this journey, I'd been a part of this journey, where once you find something in the lab, it takes 20 years before somebody's going to actually put that in there, clinically, [crosstalk 00:36:58] …

David: Not us biohackers.

Zach: I know. That's why I'm talking to you. That's why I stayed up till midnight to give you this information because you guys are going to change the paradigm. The exciting thing that we were seeing is immediately the proximal renal tubule cells lived 15% longer. We knew there was nothing in the substrate that I just gave him that could do that alone. There was no way there was something in the Terrahydrite molecules that could deliver longevity. It meant that there was something fundamentally changing inside the human cell that was inducing, taking the stress off the cell that it would live longer. That stress I knew because of my chemotherapy research is from the redox signaling from the mitochondria.

When the mitochondria starts to sense stress in the environment, it will start to call for help and does that by sending out free radicals, these reactive oxygen species, hydroxyl free radicals are the most extreme version of the help signal. We were starting to make that connection of, "Okay, if they're living longer, we must be seeing a decrease in. We must be seeing the mitochondria reduce their call for help." In fact, that's exactly what we saw. Within three to five minutes of the proximal renal tubule seeing this, we'd see an immediate drop in healthy proximal renal tubule cells that they're ross and then would stabilize at about 15 to 20% lower than their baseline.

As predicted for longevity to happen in those proximal renal tubules, we'd have to take the stress off the cell. What it immediately told me is that our first hunch that the three-dimensional structure on that molecule looked a heck of a lot like the chemotherapy that was regulating mitochondrial function was likely right. We started to really start to gain confidence very quickly that this wasn't a molecule that was going to do anything to the proximal renal tubule cell. Very, very much different than anything else I was using in clinic. I was using high doses of vitamin D, curcumin, a whole list of alpha lipoic acid, CoQ10, QQQ, all of these things that we knew were forcing little specific pathways. This molecule family was totally different. It's totally passive. It's not trying to do anything to the proximal renal tubule cells.

What we intentioned with the creation of this product is can you simply keep it so neutral, so equal in its redox potential, exactly and not same number of electrical donors as absorbers, that all it does is act as a wireless communication network through the system to amplify the message that one part of the cell is trying to send to another part of the cell. That's the magic that we struck on really by sheer dumb luck or maybe just sheer really good intention. We really intentioned to find something that was so neutral, that would move into the environment and just like your cell phone, we see this phenomenon.

The cell phone, all the computer in there has this incredible transmission and reception capacity. You can talk all over the world at any time of day on that thing. Amazing communication device until you're more than seven miles from the closest cell phone tower and suddenly that thing's rendered useless as a communication tool and it becomes isolated. You can't talk to your friends et cetera but more importantly for the cell phone, it can't update its software. It can't defractionate. It's going to start to accumulate injury. You've experienced this with your laptop or other computers is if you get disconnected from the network, you start to accumulate damage within the operating system. You get fragmented. You get dysfunction. That's exactly what's happening to the accelerating of the aging process that we see happening in this chronic disease epidemic. People are getting disconnected from their own message.

David: For people listening, it turns out my background is in network engineering. How do we build the internet the way we do it today? We've actually applied a lot of the network engineering things, packet loss and things like that to cellular biology now. In fact, we use Shannon's Law, which comes straight out of TCPIP research, to provide that mitochondrial communication can and does happen.

Something weird happens with your cell phone. When you move away from these antennas, the further away you get, the more you get something called packet loss. What that means is that your cell phone sends something but it doesn’t get there so it has to send it again. When it does that, it uses more of the cell phone's battery. If you're in a place with a weak signal, your cell phone goes dead half way through the day. If you're in a place with a strong signal, your cell phone basically uses less power to communicate.

What you're describing with the Terrahydrite that's in Restore is you're describing this idea that, "Okay. All of a sudden now, you can send a message and it never gets lost." If people read Head Strong, my book about mitochondria, I talk about how an electron comes in from food. It essentially gets used and it goes out in air. If you're perfectly efficient at using those, your cells are working really, really well. As you become less effective at using those, those electrons leak out into your system and it cause inflammation, which is a sign of mitochondrial dysfunction and is underlying every chronic disease of aging that you can think of.

What's going on here is if you can get a better signal so every electron that comes in goes out where it's supposed to instead of leaking into your tissues. You end up with a creature that's going to live a lot longer or if it's a cell phone, the battery's going to last all day long. It's the same thing. It's fascinating that you basically found a way to, we'll call it dope the antenna here so that you can get the signal between the cells more effectively and more efficiently, at least that's what you think you found, right?

Zach: Yeah. Then, the story got much cooler very quickly. We saw a change in raw signaling, which is profound. Now, we're taking a sterile liquid that has no bacteria and fungi. All we're doing is extracting the communication network that is made by the bacteria and fungi. Then, we're putting it into, again, a sterile environment of the human cell and it immediately creates shift at the mitochondrial level. That's aha, blow your mind number one but number two within minutes of that, we were seeing changes in protein

synthesis from the DNA of the human cell. Suddenly we saw this cascade of bacteria and fungi controlling in seconds to minutes, mitochondrial activity, if you will, stress level up or down and immediately thereafter, a shift in the genomics of the human cell.

This suddenly connected my cancer research conundrum. I said, "Okay. Here I'm understanding cancer as a genetic disease and human genes turn off and your cancer suppressor genes fail and your proto-oncogenes turn on. You get a cancer but the UCLA and UCSF guys are telling me that there's some correlation between bacteria in your gut and what cancer you're going to get. Suddenly, this answered the whole thing of, "Oh, my gosh." If you have a screwed up ecosystem in your gut and you start to get perturbation in any particular direction. You get a loss of this ecosystem, you get an overgrowth of this part of the ecosystem. What's going to happen is you're going to suddenly lose a part of that wireless communication network. You're going to become vulnerable at multiple levels within the human body.

This is why the epidemics are all happening simultaneously is that we all have slightly different vulnerabilities. If you've been tracking this fascinating world of neural disease right now, it's pretty phenomenal. Right in the middle of the 1990s, suddenly the trajectory of Parkinson's disease in males in the developed world started going very steeply up. At the same time, the Alzheimer's in women started going up but in both cases, the Parkinson's rate in men or in women hasn’t changed and that Alzheimer's rate in men haven't changed. We had a gender difference in degenerative neurologic disease at the same time. We demonstrated that there was some shift in the environment in the mid 1990s that lead to a shift in the microbiome that manifested different vulnerabilities within the brains of males versus females.

That's just one example of what happened but of course at the same time, we had a huge uptick of autoimmune disease, huge uptick in cardiovascular disease, cancer and all the rest. What we're now seeing is wow! If we start to damage that microbiome. If we go after certain chunks, we're going to start to lose the parts of this wireless communication network and the human system is going to suddenly start losing the packets, like you say. You start dropping packets, you start dropping the pieces of information.

Now, the human cell doesn't know that it needs to repair until it's too late. When it's too late, it can no longer trigger apoptosis or program cell suicide because the mitochondria are damaged.

What were we seeing under the microscope that led us to believe that the DNA were doing something different? What we saw is the extracellular matrix around the human cells start to go into production. Never in the history of basic science has anybody seen proximal renal tubule cells express extracellular matrix and create cohesive kidney tissue. It's never been. Within minutes of the bacterial communication network hitting those renal tubule cells, they start making extracellular matrix, starting combining tight junctions across them, going into three dimensional structures, gap junctions, which look like fiber optic cables, by the way, start connecting through there. You've got this cohesive membrane of kidney tissue in a Petri dish never seen before. Phenomenally powerful.

The fact that that happened meant that the DNA was unraveling certain segments that would expose, promote a regions, bind the appropriate co-activators, start to build messenger RNA that would exit the nucleus, turn into a protein in the cytoplasm, export to these membranes surface, become extracellular matrix that would intelligently combine with the extracellular matrix it's now preparing on the other side from another renal tubule cell, make it cohesive Velcro structure that will act as a spot weld. I wish I could really download just the craziness of how complex this was.

David: At this point, can I get an IV bag of it and inject some into my cerebral spinal fluid? That's how I literally think of it, like, "Okay. Sounds good."

Zach: You and I are very similar. I spent about a year IVing this stuff in my clinic.

David: You can actually do it by IV? I was kind of joking but is it sterile, because I would.

Zach: Yeah. Yes. I would not recommend you do it. The reason is, we're finding out it works better where and it ends up being obvious.

David: In the gut because of the gut biome, I'm guessing.

Zach: Bang! That's where it's supposed to originate from. After all this time of probably putting my life at risk by starting IVs and pumping the stuff into my body because it seemed sterile but every time you stick an IV in your arm, you've made yourself prone to something.

David: I might have injected a few things. I hear you.

Zach: Yeah. All right.

David: Nothing that makes me high, by the way. Just things that make me live longer.

Zach: From my idiocy. I started to realize, "You know what? This stuff's going to work better in the guy," because we were seeing magic happen by just giving it orally. We backed off of doing any IV therapy many years ago. We're finding the magic really happens when putting it into the gut and letting the bacteria and fungi do its thing.

David: Do people use it rectally? It seems like that would be at least as effective.

Zach: Very effective. Yeah. Even something as simple as spraying it topically for hemorrhoids is extremely effective. We have a nasal product that's become one of our fastest growing global products. Everybody has nasal, sinus, post-nasal drainage. The crap that's going through your nasal sinuses is terrifying.

David: I want to break in for a second there. Zach and I don't have any financial arrangement here. I just brought him along because he knows what he's talking about. Yeah, he's selling some stuff. My experience is that the people who believe enough in what they're doing, to put everything on the line and make a product, I tend to listen to them, but

yeah. Zach does have a product here. I'm absolutely interested in it. At this point, probably, I drink one bottle of your stuff. It's three-quarters gone, sitting in my dining room table. I can't tell you that this stuff works. I can tell you the science is really intriguing here but just so you know, yes, there's a commercial interest from Zach but not from me. He's just here to share info. That's all on the table.

Zach: Absolutely. We'll talk about it as we close up the session is how do we really bring this stuff in because I believe it's the science of what we've discovered that's going to change the world and not a product. We're going to talk about what do you do once the wireless communication network is there because you're not done. This is a sterile product. We're saying the microbiome governs everything. What do you do from there? That's the most potent reason I'm here with you guys is because you guys have a large enough community that consumers are ultimately in the most powerful force of change that we have. I am completely hopeless that the government is going to make the changes fast enough to save our soils, to save humanity. I think that you guys can be a part of that force.

All of my income comes from my own operations, my clinic, my basic side operations, our research and development, our products for animals and beyond. I'm not paid by any third party organizations but I am absolutely and fully invested and have huge conflict of interest in everything I'm saying regard the …

David: You've got nothing to apologize for, not on this show, for doing that.

Zach: No apologized at all. In fact, I'm excited to keep the conversation going beyond the product. Exactly. We'll keep diving into the protein structure, if you want.

David: There's protein structures. The other thing I want to ask you about and this is something that's, I've been writing a lot about this is we're doing things to destroy our soil because we basically say, "Oh, that only affects bacteria, therefore it doesn't affect us," which is just a false assumption but spraying glyphosate on soil disrupts bacteria in the soil that now we know toxic your gut biome. It also disrupts your gut biome, which then is going to just roll up throughout the system and generate all these weird problems.

What's your take on, you mentioned earlier pesticides and herbicides and things like that. What's your take on what's that doing to the soil and then what's that doing to our mitochondria?

Zach: Yeah. I got to give a shout out to Dr. John Gildea. He's my chief science officer, one of the most brilliant PhDs on the planet. He's the one that really has untangled the story on glyphosate but better than perhaps anybody else on the planet but we've published some papers on this. You can find some peer review journal articles on the role of glyphosate and this gut protein structure and everything else and the microbiome on our websites.

But John really helps tease this out early on when he saw what was happening with this communication phenomenon when we were seeing genomic changes in gut lining

because after the renal tubules, we went right to the intestines because obviously the microbiome dominates there so we're really curious to start to tease out the relationship between the microbiome and this extracellular matrix protein structure of the human gut.

Glyphosate, we'll start at the soil. Glyphosate, if you're not familiar with it is the active ingredient in the famous weed killer called Roundup. Roundup, made by a company you've probably never heard of called Monsanto, Roundup got patented in 1974, went on the market in 1976. Killed everything it touched. It killed anything, weeds. It killed crops. It killed anything. It's an organophosphate is the formula's molecule. Its backbone is glycine, which is a critical amino acid for building human bodies and any other biology.

David: That's what's in collagen, primarily, by the way.

Zach: Yes, exactly. You take a fundamental structure that is critical for the ultrastructure of your human body. Then, you adulterate it with a phosphate group on one side and amine on the other group, which is a nitrogen combination. You get this around the glycine molecule. You create now an organophosphate.

This is now in the same category of another famous chemical made by Monsanto, which is called Agent Orange. If you're really young, you maybe haven't heard of this but in the Vietnam War, we were dumping enormous amounts of this Agent Orange on the jungles of Vietnam. We were trying to defoliate the jungle so we could see the enemy and shoot them down with helicopters and everything else. We were in this environment of killing plants with chemicals.

Then, the war got over. By that time, we found out that Agent Orange was causing cancer and all kinds of horrible things on people's skins. They thought, "Okay. It's a little too toxic there." They were looking for a less toxic version of Agent Orange to kill weeds. Great business plan because nobody likes weeding their garden. They thought, "If we could just have a chemical you could spray on your weeds, we'd make tons of money." They made this chemical.

Interestingly, they did not patent it as a weed killer. In fact, they went on to re-patent this thing many times. Never in its lifespan as a chemical has it been patented as a weed killer. It's been patented primarily as an antibiotic, antifungal, antiviral. Every single-celled organism that thing touches, it kills. It kills plants as well.

Number one thing is that glyphosate, which is now the number one chemical on the planet. Four and a half billion pounds of glyphosate dumped annually around the globe now. Unfortunately, it's a water-soluble toxin, which should never happen in nature. We had a water-soluble toxin, meaning, it's going to go to every level of the environment. It's in the air you breathe. It's in 75% of the air of the US, 75% of the rainfall. It's penetrated every level because of its water nature. That means it's doing the same thing in your body. It's in your bloodstream. It's in your urine. It's in your cerebral spinal fluid. It's going everywhere as this water-soluble chemical that's all over the place now. It's in every bite of food we eat. I believe it's in every drink of water. It's everywhere.

We've created this ubiquitous antibiotic. The first thing that we've done with glyphosate is begin to really sterilize the environment starting with our soils but obviously as soon as we start to ingest that or breath that, we sterilize our nasal sinuses, we begin to sterilize the gut. What you end up with are the few organisms that can exist in the face of that chemical. This is very much like a hospital where you dump a bunch of antibiotics on the population, you end up with antibiotic-resistant bacteria that dominate a hospital. You get MRSA, VRE, and all these horrible invasive pathogens.

Same thing is happening now in our human gut. The last vestiges of survival in this environment of glyphosate are things like Klebsiella, Clostridium Difficile, yeasts, the candidas and stuff like this. These guys are not bad guys. They didn't show up to attack us. I think even in integrative medicine, we think of yeast or candida as bad guy and we need to kill it or we think of lime as a bad guy. We need to kill it. These are simply the last survivors, guys. We got to love these guys as much as anything else because they're there just to create a little bit of microbiome for us. These are the tough survivors. We need to start respecting them and realizing, "Okay. These are the weeds that have survived. They're trying to bring some nutrient into the environment for our body." We're going to start to make this shift, I think, to realize that what we think of as pathologic states of the microbiome right now are simply the survivors of living in a glyphosate rich environment.

David: That sounds bad. There's a reason I live in an organic biodynamic farm on enough space that I don't get huge exposure but I travel 125 plus days of the year. I know I get a lot of this crap. We simply have to stop doing that. If you want to not weed, there's a simple answer. Use robots. They're happy to weed for you but seriously, that's how Monsanto can save their business model is just solar-powered robots that pull weeds. Then, you can stop spraying crap on our soil. There you go, guys. No charge for that.

Go ahead and do that and stop spraying crap in the environment that's supporting my biology. What are we going to do about that as people looking to live more than 100 years and not get Alzheimer's and Parkinson's and every one of these other diseases that comes from a breakdown in communication and electrical generation networks in our bodies? You know more than the average bear out there, given your background, given all the research you've done. What are the best defense systems that we can have other than water filters?

Zach: Absolutely, so step one, again is the microbiome because we're now finding that there are species of bacteria and fungi that can break down glyphosate pretty effectively. I put all my hope right back into the microbiome that we're killing with this stuff.

The way that I do this in my patients, we get the wireless communication network up and running. Then, we get into as many environments as we can because the nasal sciences are actually, if you look at their structure, are built to be capturing microbiome. It's really cool. We have these turbinates inside of our nose that force a turbulent airflow through them. It creates nitric oxide and a lot of other really critical things of biology with that turbinate flow but I think the primary thing is does is we create a sticky mucosal surface in the sinuses. We force a turbulent airflow through it. Even the hair

follicles that grow in there seem to be perfectly designed to grab aerobic and anaerobic bacteria from our environment.

This is what I have my patients do. If you really want to heal from your breast cancer or any other disease, you got to get back in touch with nature. There's absolutely no product on the market that's going to do it for you. You've got to re-engage with that biodynamic globe that we were born into. That biodynamic environment is what's going to heal you. The way in which you do this is seek out as many environments of Earth. I've told you now that the whole Earth is sprayed with glyphosate and everything else but you're going to find niche environment.

I have to love the United States for this one thing. As Teddy Roosevelt, god bless him, put a hell of a lot of land under non-use. We have a lot of national parks that are not being visited right now. We are not visiting these places. I invite you to go explore as many national parks as you can in the next couple years because there is still some intact microbiome. I would tell you my top three favorites, except you all would show up there but go find your own favorite few because I guarantee you, you're going to find microbiome you have never experienced in your life.

I'm so confident of that because most of us are living in city and urban environments or rural farming environments that have not had steady, healthy, ancient ecosystems for not just decades but actually centuries. You remember the whole Dust Bowl in history. Dust Bowl was happening in the 1920s and 30s because we killed the top soil before the herbicides and pesticides. We've been screwing up soil for a good long time, not in the ecosystems of many of these parks. Find yourself some ancient parks and go and breathe.

We think of fermented foods and probiotics. All of that is just spitting in the wind compared to the potential of just breathing good quality rich air with microbiome. I have my patients go out to Virginia Beach and breathe air and then down in Southern Virginia down by the swamps. Then, up into the Appalachian Trail, be by the waterfalls. Breathe ancient ecosystems. Along the East Coast, a huge hot spot is down in Tennessee, the Great Smokys one of the most diverse ecosystems on the planet. I traveled as extensively as you do and I try to make sure that at least part of that travel's taking me to far flung places. Just came back from the Great Barrier Reef and start breathing air down there that I know I've never been exposed to. Some of the islands along the Barrier Reef I know have some profoundly ancient microbiome.

You start going into these environment that you've never been and you're adding years to your life. I really have a profoundly strong conviction that the more you can breathe in new environments, the longer you're going to live.

David: One of the things that I start doing, to the point it's one of my portfolio companies, I spray soil bacteria in my house. It's called Homebiotic. They do that because I know that unhealthy indoor environment, you get this toxic mold thing, which has had a profound effect on my health. That stuff can mess you up when you get water damage in your house. Where I'm sitting right now, I misted a bottle of Homebiotic around. It's not a

diverse ecosystem. It's basically seven species that I know eat mold, to at least create a balance because I know a sterile environment not good for me.

Is there something you can do? I haven't had great results with it but I've heard lots of people talk about essential oils and terpenes as signaling molecule or is it straight up, you need bacteria from all over the place?

Zach: You need it all. This has been the limitation of our probiotic industry. You take three species or seven species and then you multiply it to 35 to 50 billion and now we have a couple on the market that are bragging a trillion copies of those bacteria. Now, you're creating a monoculture. That's the opposite of what you're looking for as far as creating this biodiversity, which will then create the incredible diversity of the carbon molecule that will go onto be the communication network, blah, blah, blah.

I applaud every effort to get bacteria to the environment. I'm not saying stop the Homebiotic. What I say is you're probably going to win the game if you just take your shoes off, step outside and like your dog, run around in the grass for 5 or 10 minutes and then come back in. You're going to be scuffing around in the dirt, ideally playing with your kids or dog down in the dirt, chasing each other around, tackling each other. This is how we grew up. You remember doing this. Now, you look at a playground at an elementary school today. You're lucky to see a kid on a swing but you're certainly not seeing people wrestling around in the dirt anymore. They're too worried about their designer jeans to get dirty or whatever it is.

We have separated ourselves from just fundamental easy, cheap, frankly free mechanism of microbiome exchange, which is touch Mother Earth. You're in a very fortunate setting is that you've got this huge garden of our own. If you don't have a garden at home, grow a plant. Put a pot out in front of the door. Put a pot in the window in your kitchen. Get a few plants going around and make sure you touch it every day.

One of my biggest passions right now is eating off the vine. You want to get crazy with me, do this. It'll make you giggle and laughter I think is one of our best longevity markers but eat a tomato off the vine. It is a completely different experience than picking the tomato and then eating it half an hour later on your salad. There's going to be a layer of dust and this hairy quality to the tomato before it's picked. It's got this little fur on it that I think is capturing microbiome and other things on it. If you pluck it, there'll be often a little spider web on it. There's biology on the surface of that tomato that you're missing otherwise. Get crazy with it. It's fun.

David: It's funny. My kids since they were very little. They just go out into the garden and they'll pick rosemary and oregano and mint. They just eat it. Same way, when I make a salad. At least during summer here. There's not much growing this time of year but literally, I'll just go out there with a pocket knife, whack off some of whatever it's going to be. Throw it in the blender. That becomes our salad dressing.

Zach: That's it.

David: It sounds weird but I guess most people don't do that. It just tastes better when it's really fresh.

Zach: Really fresh is a game changer.

David: Everyone listening to this, I would say 99.999% of people, they simply are not going to do that. They might have a plant but they're living in a condo. They're living in a high-rise. Should I be gathering little Baggie of freeze-dried dirt everywhere I go and shaking around my house? How are we going to go to Mars? How are we going to get this on our space stations, which currently have 4,000 species of bacteria growing in them? They just tested it, finally. "Oh, look. We have diversity." I'm like, "You call 4,000 diversity?"

Is there a way to transport this? If we are going to become a multi-planetary species, if we're going to be able to live in the cities where the vast majority of people live, how do we get this into our bodies without having to go out and spend time in nature because frankly, there isn't that much space in nature for the number of people we have here. Is there a way to do this or are we all screwed?

Zach: Yeah. That's a big ethical humanitarian question right there. I think the sad reality that I'm increasingly facing in my world view is that we are going to lose a lot of people. There's a lot of people that are screwed because A, they're not going to have access to this information fast enough. B, they're going to feel hopeless or incapable of enacting something that would approach a solution for them in their lives. Sadly, we will lose a lot of people. I think we already have lost. I know that I've lost hundreds and hundreds of patients over the last 18 years of being a doctor that should have lived longer or at least much more peaceful journey than what they had. We're already losing them and we're going to lose them faster and faster with each given year if we can keep the current trajectory.

What I'm putting my hope in is that there's going to be a segment of us that communicate and push the envelope. Dave, you're a hero among us in your rabid effort to get the information out to the public as quick as it is discovered. Like I said, in academia, it takes us 20 years to even approach that. You're cutting that time of knowledge to delivery much like Elon Musk is changing that equation for space travel. Cut 90% of the overhead and we're going to win the game. You're doing now with information. We've been talking all about cell-cell communication on a microbiome level but the reality is this podcast, your Bulletproof conferences, everything else, you're a huge piece of that puzzle. I don't do that to pump your ego up but I'm using that as an example to everybody listening of you each are an epicenter of change.

I've met many of you. Apple approached us last year here. In Pasadena, I was watching you guys pass through the booth and then, come into my talk and everything else. There's an energy that you guys project that is atypical in the community right now. The vast majority of people are really sick right now. Your community is vibrating at an extremely high level because of the efforts you've put into your own human biology and the biophysics underneath that. What that means is each of you are becoming a massively powerful nidus for change.

My conviction is that if we can start to communicate real respect and love for one another with that sort of high vibration, it's going to not just stop at the humans but will start to respect the environment at such that the environment is going to sweep right back in and heal the damage that we've done. We are going to redesign our cities, by the way. You're talking about people stuck in high-rises. We're going to redesign structures. We're going to stop building huge, giant rectangles of drywall and call them homes. We're going to start putting microbiome highways into our sidewalks, into our road systems, into the foundations of homes, into the floors we walk on. We're going to have to re-engineer everything because I guarantee you we are one or two decades from losing it. At our current trajectory and if you saw my talk at Bulletproof, we're only 16 years away from hitting one in four kids with autism.

David: Yeah. A lot of people are worried about global overpopulation. When I wrote my very first book, the better baby book, I'm not worried about a global population boom because our fertility is dropping so precipitously as a species, give it a generation or two, we don't have to worry about having seven billion people here. That is damn scary to say. That is just a fact. I'm planing to be around to watch that. I'm going to be an outlier here. I hope I'm not the only outlier. The knowledge that you're sharing just with the hard science, way deeper than I've gone. It's been a long time since I've worked in a lab. My lab would have been more full of blinky lights and network anyway but that kind of knowledge, I've just met so many frustrated researchers and doctors and bioengineers saying, "I've figured out something important and no one will listen until they're dead." The history of medicine is all the old doctors die and new ones come in and then it changes. We don't have time to go through 20 generations of medical professionals to do this. Basically it's one of those change or die scenarios here.

Without trying to sound dire or anything, I think it's the best time ever to be alive because our ability to change is faster than it's ever been. Our ability to learn is faster than it's ever been but if you don't take advantage of that, you might not like what happens when you wake up one day and your legs don't work or whatever else happens because a network in your body broke down because you can't make energy anymore. If you go, "Well, why? What did I do?" There's lots of things that you probably did and didn't do but there are some things you could do that are probably protective and they may not be but they probably are and they're worth doing if they're within reach for you.

I'm like, "Okay. I don't really like getting on airplanes as much as I do. It'll be more convenient to live in the middle of the city but I think I'm making the right call for the long term." I don't know, though. I don’t think you know either, at the end of the day. You're pretty strongly convinced but there may be more, right?

Zach: Oh, I hope we're just scratching the surface of our potential. I'm right there with you that I believe that nobody has defined the optimal lifespan let alone the optimal function that we could perform within that lifespan. It's clear that our human biology is dialed in for extremely productive, long life.

I run a hospice service for a lot of the last decade. When you're running a hospice, it's not unusual for us to still meet patients that are 105 years old. You meet 105 year olds

who still sharp, it's a phenomenal thing to witness but the interesting thing. When they die a year or two later from just slow demise. No specific disease. They just turn off and shut down like you said, on their own terms, by their own means, they turn off the lights. At that moment, right before they decide they're going to go, every single organ system in their body is plum full of stem cells that are ready to turn on and replace every tissue of their body. It doesn't matter how old we measure that biology, too. Stem cells all over the body with the primordial knowledge of how to build that body from scratch over again with no injury within it.

That's our potential to rebirth, rebirth, rebirth in the body instead of continuing to surrender to this decay process, decay process, decay process. Like you said, I don't have any confidence that I know the whole story at all. I'm profoundly blowing my mind just over the scratching the surface. I can't wait for 10, 20 years down the road. I'm extremely excited to be alive right now because it's not our population that's just going exponential. It's not just our diseases that are going exponential.

Our knowledge is going exponential. Our ability to communicate that knowledge through internet and everything else that's coming behind that, super exciting. I think we're going to see an acceleration, obviously of what this community knows, what the biohackers are doing. You guys are going to start having these conferences more frequently I think because the amount of information that's going to emerge every three months on this planet over the next 5 to 10 years is going to be mind-boggling.

David: It is, indeed. We could go on and on but we're coming up on the end of the show. What I've been doing for the past 450 or so episodes is I've asked everyone for a piece of advice. If someone came to you tomorrow, Zach and they said, "Look. I want to perform better at everything I do as a human being," and that opens it up to there's psychology, there's biology, there's whatever else but basically your path of becoming someone who's changing the game in your field of biology and medicine and healing. If someone comes to you and says, "I want to change the world in a similar way," what are the three most important piece of advice you'd have to offer them? What matters most?

Zach: Number one, you are enough. Stop stressing yourself out. You are your worst enemy and you are your greatest advocate so step into your purpose and don't be afraid of it, number one. You are enough.

Number two, stop thinking of yourself as human. You have 70 trillion human cells, which is an impressive number, but you have 1.4 quadrillion bacteria, fungi et cetera and you have 14 quadrillion mitochondria living within you. You are, if anything, a vehicle for the microbiome to travel the world and communicate more broadly a purpose of life itself. I think if we stop thinking of ourselves as human and start to think of ourselves as a connected biology and to the entirety of Mother Nature, we were going to win the game on a bigger level.

Last of all, we completely underestimate the power of love, which sounds completely cheesy for a doctor to be saying that but I have seen it absolutely be the missing equation in all of this pursuit of longevity and the fight against disease and everything else. If you can biohack all day long and if you have not found pure love for yourself, you

can't live that golden rule. You can't love others as you would love yourself because you're not loving yourself. Fall deeply in love with yourself. Then, let that love pour over and then cheer environment, your kids, your pets, your community at large. It sounds cheesy, it sounds like an emotion but in fact, it is a vibration. That's the last and third most powerful.

David: Yeah. That is absolutely real. Thank you for saying that but you forgot one thing. You fall in love with yourself, your pets, your loved ones, and your garden. All right.

Zach: Yes. Fantastic.

David: On that note, Zach, it's been a pleasure chatting with you. I love how big you think. Where can people find out more about you? What website shall they go to? Certainly, it's okay to talk about Restore, wherever they can get [crosstalk 01:14:36].

Zach: Yeah. The easiest place, just for all kinds of information from me as far as all the different things I got my hands in as far as exciting projects is zachbushmd.com. That gives you a download of my life in a snapshot. The product is www.restore4life.com, restore4life.com. We're on Facebook, Twitter. You'll find us all over the place but restore4life.com and zachbushmd will get you most of the information you're looking for.

David: All right. We'll include those in the show notes and on the blog and things like that.

Thanks again for your work, Zach. Have a wonderful night late in New York city.

Zach: Thank you guys so much. I appreciate it.

David: If you like today's episode, you know what to do. Head on over to iTunes. You can go to bulletproof.com/iTunes to make it easy and leave a review of this show that says you were inspired, you felt hopeful, or maybe you just really decided to go for a walk in the park. Whatever it is, leave me your review. It's a way to tell Zach he did a good job and to tell me I'm doing a good job. I'd be grateful if you'd take a second to do that. Bulletproof.com/iTunes.