

Zach Bush, MD Interview 1

Heal Your Body from Your Membranes to Your Mitochondria: Food Sensitivities, Allergies, Glyphosate, Gluten, Your Microbiome, the Extracellular Communication Network, Gene Regulation, and the Shikimate Pathway

Brendan [00:02]: Welcome to the Eat4Earth event. We're exploring how you can heal yourself, your loved ones and the Earth with food. This is Brendan Moorehead and I am very excited to be speaking with Dr Zach Bush. Dr. Bush is a medical doctor and researcher, and he's one of the few triple board-certified physicians in the country with expertise in internal medicine, endocrinology and metabolism, and hospice palliative care. The breakthrough science that Dr. Bush and his colleagues have developed offers profound new insights into human health and longevity. In 2012, he discovered a family of carbon-based redox molecules made by bacteria. He and his team subsequently demonstrated that this cellular communication network functions to compensate for glyphosate and many other dietary, chemical, and pharmaceutical toxins that disrupt our body's natural defense systems. This science has resulted in a revolutionary class of dietary supplements including the product Restore (now called ION Gut Health). Dr. Bush's education efforts provided grassroots foundation from which we can launch change in our legislative decisions, ultimately upshifting and consumer behavior to bring about a radical change in the mega- industries of Big Farming, Big Pharma and Western medicine at large. Dr. Bush, I'm really excited to have you here.

Dr. Bush [01:21]: Thank you so much for having me, Brendan, I'm really excited to be here.

Brendan [01:24]: Awesome. So you've made a series of discoveries that have changed the course of your career, and it's changing the lives—are changing the lives—of many people around the world. What exactly did you discover, and how did you discover it?

Dr. Bush [01:39]: What we were really trying to untangle, and I guess to answer that in order to ... what we discovered is that there's methodology in the single-celled organisms to communicate amongst one another and unbeknownst to us at the time, but what's untangled over last few years, is the realization that as the bacteria and fungi begin their journey into a cooperative community and that huge communication network they make, they actually have the ability to communicate across human cell systems to the mitochondria within us and actually right down into our own nuclei to change the genetics of our own makeup. And so they really modify which genes in our body are turning on and off, which proteins we produce, an extraordinary story of just this cooperative living within our ecosystem. The way in which we came upon that discovery was in my nutrition clinic. And so I had previously been in academia for about 17 years, first at the University of Colorado and then at the University of Virginia. And I had gotten through a lot of training and education and research, and my research had really moved from mental health disorders and neuroplasticity in the late 1990's to ... by the time I left in 2010 I was studying tumor genesis and how cancer cells grow and how nutritional aspects can function as chemotherapy to kill cancer cells. So I'd really had a broad journey through my educational background, and much of that was because I wasn't being satiated by my experience. I was really feeling like at each step of my education I was lacking any real tools that were having a meaningful impact on my patients' quality of life, et cetera. And so I finally left in 2010, the academic environment, to start just basic nutrition clinic in rural Virginia, a town of 550 people. I really believed at that time that my career had just taken a really drastic turn, and I'd probably never get the chance to do my research and teach again. And I just ... academia was actually collapsing

with the recession; our department of endocrinology had fallen from 70 faculty down to 25 and you know, everything was kind of in free fall in academic medicine. So, I said I'll just to kind of reengage in my life as a physician, and I was suddenly all alone in a primary care practice teaching people how to eat food. But really what I was doing is I was suturing up farmers, and I was treating head injuries, and I just kind of front lines doc again, and I hadn't done that in a long time. And it was a great experience just to get really reacquainted to my patients and find out that I was capable of being in community with patients. And unfortunately, that's really lacking from medical experience. And so 17 years of training and three board specialties, you would think that I was just steeped in that. But we're so isolated in academia, and we're so isolated in hospital systems and through insurance models. And all this stuff that gets in the way of real patient-provider relationships. And so I got that experience out there, and ironically that kind of human experience of communication community was a macrocosm of what we were about to discover on the microcosm level {which} was that our patients who were not thriving on nutrition were really starting to fail on the healthiest foods out there. They were—the inflammation was going up, not down. All kinds of unexpected things were happening. And so it made us drill down into what's wrong with the food, or has the food changed, or what is the secret of food even because as you start to really get into nutrition you realize nobody actually really knows what they're talking about. And that's why there can be 32 opinions on what you should even eat today. And everybody seems to have the same firmly held beliefs about what you should or shouldn't be eating. And they're all at opposition to one another. So it's really amazing how little we understand about nutrition. And that's what I was kind of humbly realizing in my own journey is like, I don't even know what I'm talking about anymore when I was talking about nutrition. So in that journey we started to ask, well, “What about the soil?” Because it's where the plants come from, and that was the moment we discovered this family of molecules that you referred to and that discovery really uncovered this beautiful truth of the single-celled organisms are trying to really create the foundation for communication all of life to spring from, which I guess makes it a lot of sense since we probably all spring out of the soil at some point.

Brendan [06:04]: Yeah. And you developed a product. I'd like to kind of summarize—I don't know if you agree with this—but it's ... you're healing our body with ancient soil. Tell us more about that. What is this communication network that derives from ancient soil extracts, I guess, that you've modified to make them ... to bring them back to life physio-chemically.

Dr. Bush [06:29]: Yeah, that's pretty good description actually. It's a hard topic, and you did a good job with that. So the discovery of these molecules is largely because of the similarities that I had seen with my biochemical research and in the pharmaceutical industry, and what I recognized was that there was some arms off these central carbon rings that were ... had the potential to release and absorb hydrogen molecules really easily because of their three-dimensional structure. And when you get something, a molecule that's able to release and absorb hydrogen, you get what's called a redox phenomenon, and this is a reduction and oxidation event where you're able to donate or absorbs electron exchange very quickly. And that seems to be the magic on a lot of levels of the cellular environment. The departure from anything I'd ever experienced before was that there was this huge carbon backbone on this thing. Because previous to that I'd been studying mitochondria, and the mitochondria live inside of ourselves, and they look a lot like bacteria. Their DNA actually looks like a virus. It's a ring DNA. And so it's very much a primordial structure, these mitochondria. But human life is impossible, in fact, not just human, but any multi-cellular organism's life is impossible without the mitochondria. And the reason is these eukaryotes, these multicellular organisms, which could be an earth worm or human ... we are incapable of creating fuel on our own. We have to be fed, and so at the cell level the mitochondria are responsible for taking the protein that's now converted by your liver to glucose and sugar, and then the fatty acids that are

coming out of the fat sources in your diet. So you've got basically sugar and fat that are being derived from either carbohydrates or protein, and then you've got your fat. Those are being burned by the mitochondria, and the mitochondria in turn are fueling the human cell or the multicellular organism with ATP or adenosine triphosphate, one molecule which is really the fuel for the whole system. It doesn't matter if you're a brain, a muscle, a liver cell. All of it's running on ATP. Well, I knew—and my research had really been in the cancer environment around the fact that if the mitochondria are damaged, they can't make enough of these redox, and as well that kind of decreased mitochondrial threshold or our capacity—this is a real hallmark of just the natural aging process. And so I knew that this was a critical piece of health. If we were going to reengineer a healthy body, we were going to have to have a huge signaling system. And at the time I and all of the researchers in the world, we were really thinking that redox signaling was really coming from these tiny, little, ethereal oxygen-based molecules that were being made through the Krebs cycle and then subsequently actually the electrons from Krebs cycle through what's called the respiratory chain in the mitochondria. And so that's a lot of complicated pathways you don't need to know about, but basically think of it as compost. And so the mitochondria are making this compost-type waste product that we literally thought was waste for many, many decades and we thought that was harmful waste that needs to be cleared or else it would kill something. But it turns out that that waste is critical. There is no such thing as waste in biology. In the end, biology's always reutilizing and uses every part of the buffalo as the Indians would say there. So you've got this phenomenon where every piece of fuel is being used, and all of the exhaust that's coming out of that fuel production is making a communication network down at the cellular level. The aha moment of 2012 when we discovered the carbon molecules that would become Restore and other dietary supplement lines would be that the bacteria and fungi that are in the soil don't have mitochondria. And so for that reason, they would have to make a unique subset of their own ion exchange. And we've recently untangled this ... not me, but we as a science community. UCLA and UCSD for example, are doing some great work on this right now. But they've shown that the ion channels in the surface of bacteria are identical to the ion channels in human neurons. And so the bacteria have this capacity to communicate much like your brain is. And so ... but they're not communicating with self. They're communicating with the larger organism of many, many bacteria living in community. And so that ion exchange they're capable {of} has to have a carrier, and this is much different than the human inside of the cell system where the mitochondria dwell. Inside the cells, it's like the holy of holies. There's ... it's so protected; it's so regulated; it's so carefully guided as to what the osmolality is, what the pH is, what this environment is, is strongly governed. And so the mitochondria have the luxury of living in the Hilton Hotel where nothing's ever off. You know, like room service is always perfect, blah, blah, blah. And that those mitochondria don't have to worry about those redox molecules being lost in the mix because the environment is so controlled. So these ethereal little molecules that are redox molecules, oxygen-based, last about a millionth of a second in the cell. One millionth of a second is the lifespan of these communication molecules. That's a very long time in quantum physics. And so a millionth of a second actually is a huge signal when you're talking quantum physics land. And they're using these signals to go out and pulse across a whole cytoplasm of a cell, which is, you know, like a galaxy in and of itself when you're down at this molecular level. But it can also shoot into other cells because the cells are tied together by gap junctions, which are like fiber optic cables that run between each other. And so you can send these redox signals of oxygen, ethereal molecules, from a single mitochondria and get a regional response. Now think about the bacteria and fungi. There is no control around that, their environment, and so the pH may be changing from an acidic environment to an alkaline environment in a single day in the life of a bacteria. Or think about the bacteria that are in your mouth, and you swallow and then they might end up in your colon. The pH just went from seven to three to eight to seven just in, you know, a few inches of space. So that bacteria is seeing a huge stress environment from a pH standpoint. pH of course is acid. Acid is hydrogen

ions, and so that's gonna really change the ability of a redox signaling molecule to survive. So there's no way an oxygen-based high redox signaling molecule is going to be able to really survive and do a communication network in these adverse environments of your gut or the soil. You take a shovel into the soil, and you flip it over. You just changed the entire environment; pH has changed; sunlight's on it, you know, just diversity all over the place. So the bacteria and fungi had to create a communication network that would have stability to it, and that's what we found in 2012—this eloquent carbon backbone chain. And I'm talking too, like I discovered this personally. Nature discovered this billions of years ago. I just got to witness it and say, oh my gosh, I think I know what that might do. You know, there's no such thing as discovered, really, there's nothing new under the sun as King Solomon said. And so the reality is Nature figured out how to communicate in these adverse environments, in the bacteria and the fungi. This is a really interesting timing in our understanding of human biology for this discovery to happen, and the reason is because we knew that redox molecules somehow were kinda governing the inside of the cell environment. They were helping govern everything from internal metabolism, genetic production, and all this stuff at the human gene level, but we hadn't been paying attention to the importance of this extracellular matrix, the outside of the cell environment. And I think this is, my suspicion is, we aren't quite there yet. I think it's going to be 2020 to 2030. That decade I think will be the decade of the extra cellular environment. That's when we will know more about the extracellular environment in that decade than we ever have in all biologic history, and the reason is going to come down to the fact that we're starting to see the truth that bacteria and fungi are governing so much of human genomics and human health. You can't pick up a peer reviewed journal anymore without ... it doesn't matter if it's endocrinology, neurology, pulmonology, every journal is saying there is some link to bacteria. And right now all they're doing is correlating this species of bacteria with this organ system or this disease. It's cooler than that I believe. I believe that it's so much cooler than that because it's not the bacteria. It's what the bacteria are saying to each other. And we've seen this, and this isn't just in our lab. There's many labs around the world now that are starting to realize that if you study what's going on in that kind of soup, when you ... in a petri dish when you have a single bacteria growing {it} changes radically if you put two bacteria into that environment. And so now they're doing cross-species communication. They're changing each other's genomics. They're changing what each other are making. So we're starting to realize that when you start putting multiple species together, the whole thing changes and that's what we're seeing now because our lab is taking that bacterial environment and putting in the context of human cells and we're watching human biology be redefined every day. So really exciting time where we're starting to realize the mitochondria are taking care of the inside [of] the cell; bacteria and fungi are taking care of the outside of the cell environment.

Brendan [15:55]: And I've heard you ground this in very clear ways as far as how this impacts us personally because you've got the tight cell junctions ... so many people are becoming aware of gut dysfunction, so-called “leaky gut syndrome”. The tight junctions between the single ... the cells of the single layer of cells that line our gut ... they get pried open by certain things, and glyphosate and gluten are two of those things. And you've done tests to demonstrate that these stabilized redox molecules created by bacteria in ancient soil—and I guess you went to the ancient soil for a reason, because you couldn't find good soil today, and that's the whole reason for this conference, this summit, is we've got to rebuild soils. We've got to rebuild biodiversity in the soil of the planet and in our guts. And like you're pointing to when you put two bacteria and then more bacteria together a whole new universe erupts, and the signaling goes to a different level. And we're ... I guess we're completely, almost completely—we'll see how much in coming decades—governed by this. We think it's our genes that are controlling us, but ... (laughs)

Dr. Bush [17:12]: We need to get some serious humility going. We are so outnumbered.

Brendan [17:17]: Yeah, it's quite interesting. So now we're going to realize that at the biological level we are not separate from Nature in the least. And we've been making ourselves so. And I love how you've said in another context that antibiotics followed by maybe a little bit of yogurt, probiotics, we're kind of creating a monoculture in our gut. We're losing the signaling, I guess. Is that what you're saying? The signaling from the biodiverse organisms in our gut when we do that?

Dr. Bush [17:53]: You just presented a lot of great topics that we didn't hit on. So maybe I'll spin back to your tight junctions real quick, and we'll just give a picture to the audience of that. So tight junctions are the Velcro-like proteins that hold the carpets of membranes together. So the biggest membrane in your body is the sinu-nasal system that goes into your gut. So it starts in the nose (and) runs all the way to the rectum. So that huge gut membrane covers about two tennis courts in surface area. It's made of over trillion cells. That massive membrane is all knitted, knitted together by these Velcro-like proteins. And so they're intelligent too; they're not just not structural. They actually are gatekeepers. And so they're sensing what's on the luminal side, where your food is passing and all the bacteria are living and everything else. They're sensing that, and when it's time to open up and let large macromolecules through, they unzipper, allow stuff to come in, and then zip right back up. So these intelligent gatekeepers that are moving a lot of the large charged particles and macro molecules from your food and intestinal environment into your immune system first and then into your bloodstream. And so that is really the gatekeeper for your body, and it's also really pertinently the gatekeeper for your immune system. Some 70 percent of the immune system lives right behind the tight junction system, and that's called the gastrointestinal-associated lymphatic tissue, and so the reason why we see unbelievable amounts of environmental sensitivities, food sensitivities, food allergies, environmental allergies, all of this in our children right now is because they're being raised in an environment where they are lacking the bacterial biome that would support that extra cellular matrix. And so as you spoke to with the antibiotics, we've shown now really definitively in our group, and this is what I lecture on all the time, is that if you look at the CDC, the Centers for Disease Control, maps of chronic disorders in America, you're going to see a huge overlay correlation with the antibiotic prescribing of physicians. And so you don't have to look at infectious disease. Look at things like cancer and things like that. You see this huge overlay between antibiotic prescribing behavior and chronic disease. And so the more sterile we get as humans, the more we are prone to chronic inflammation and disorder of the gut. And so that is a really kind of the background of physiology for you to understand why the bacteria and microbes that are living around you are so critical. The fungi and the bacteria that are living around us are building this communication network to help improve our sensing at this cellular matrix environment of the extra cellular matrix, the gatekeeper between the outside and the inside.

Brendan [20:34]: And how is it that molecules like glyphosate, the main ingredient, one of the main ingredients, in the Roundup branded herbicide, and gluten, which is I guess one of many plant lectins that has become the celebrity of the potentially damaging plant lectin world ... how does it actually affect this, these tight junctions? What's the mechanism? I used a word that sounded like a physical action—prying—but that's not accurate. How does it work?

Dr. Bush [21:07]: Yeah. So it's actually really a cooperative relationship with the gut lining. So gluten of course has been, and all the plant lectins, have been in our diet for thousands of years without any problem. I mean, we've been living healthy lifestyles, but more importantly, healthy societies have built themselves on these plants as their staple crops. And so it wasn't really until the last couple of decades where we started to see really significant sensitivity to these molecules. Gluten as a molecule isn't ... nobody's ever sensitive to that. That's a huge macromolecule that can pass through the gut if it's undigested, (and) never cause you any problems

whatsoever. It has 13 peptide structures within it, and so as it passes through the gut and is digested. It breaks down in these 13 structures, and one of those is called gliadin. And gliadin happens to bind a receptor in the intestinal lining. And that receptor, it's not important to remember, but it happens to be called CXCR3. It's kinda like R2D2 or something like that. But CXCR3 is the guy that will grab gliadin, and when that happens it triggers a chemical to be made in the gut lining, which is a naturally occurring compound, very important for gut regulation called zonulin. And zonulin unzippers the tight junctions to allow stuff through. So regulated zonulin stimulation is really important for letting stuff through. And my guess is, the relatively informed guess, is that the bread and the wheat and all these things have built-in structures, likely gliadin, to allow fiber to get into our bodies. And so large fibers, the soluble fibers that you would find in wheat and things like this that you would find like in the wheat germ, they need to get into the body to be a nutrient source. And to get through they need zonulin to open up the tight junction and go. So I think that gliadin is there in a balanced meal to go through. So like in my clinic we're not gluten-free at all. We are really a fan of naturally occurring gluten balance. And so what you want is something like a sprouted grain bread or something that's really built from these heirloom grains that still have a balance between the amount of gluten in there with the amount of fiber. Very much like the fructose story. So high-fructose corn syrup is, you know, a completely artificially derived chemical that's very harmful to the liver. Can't actually be processed well as a sugar. An apple has a lot of fructose, and it's the main sugar in an apple. And if you go to the heirloom apples, which of course nobody eats from a grocery store anymore, but if you pick an heirloom apple off a tree, the fiber is the difference there. So we've bred our apples to be these big giant, you know, Fujis and everything else to be juicy and sweet and everything else. And they're very easy to eat. They're crisp; they snap off in your mouth. If you eat an heirloom apple, if you've ever eaten one from an apple orchard that is making great apple pie or whatever, you'll know that's a very chewy apple, like it doesn't snap off and just melt in your mouth. But the difference is the amount of fiber there. So if you go back to the original nature design of an apple, the fibers were there, and the fiber is the antidote to the sugar. So same thing now, if we go to the plant lectins is if you have a heirloom grain, and you sprout it, and you make a bread out of that, you're going to have a very equal amount and a healthy ratio, I believe, of the fibers in there and the gluten which would break down into gliadin. And so I think we've just ... we've damned gluten inappropriately. I think that all the plant lectins are probably playing a really important role of nutrient delivery, and we need to go back to the way in which Nature designed those compounds and not fear them. So that gets at gluten. Now Glyphosate is ... you know, we should probably do a little bit of history on that. I know your audience is probably completely steeped in science of herbicides and pesticides just because of the topic of your summit here. But I think that, you know, it's worth kind of a quick history of you don't mind is that. It was founded in 1957 by a Japanese researcher, and the Japanese researcher put it on a shelf at that point. It's an organophosphate, very harmful to anything it touches. And so I think out of just sense of propriety for humanity, he put it on a shelf. Then in 1976, a company that you've probably never heard of called Monsanto came along and said, "We'd like to buy that patent on that molecule." The reason being that Monsanto and many of the chemical companies have been engaged in making Agent Orange. And as you remember, Agent Orange was defoliating the jungles of Vietnam and Korea and all that. So that defoliation or destruction of green stuff was extremely toxic. They knew that the soldiers that were being exposed were getting skin cancer almost immediately and just were being devastated immune systems and all that. So way too toxic of an organophosphate. So they needed a less toxic organophosphate, and they found it in this patent from the Japanese researcher. And so they bought the patents that he had, and they patented in the US, not as a weed killer, but as an antibiotic. And so it's been patented now multiple times as an anti-parasite, antifungal, basically touches any single celled organism it touches, it kills. And so that's, that's the lifespan of this chemical glyphosate. Well, glyphosate, it's worth noting, is only one of the horrible things in what we call Roundup today. Roundup has these surfactants and other chemicals that are

designed to break apart cell membranes and deliver the chemical in deep into the weed or whatever it's trying to kill. And so the Roundup, though, is the carrier for this glyphosate molecule, and what our lab is publishing right now is the mechanism by which that glyphosate is interacting with gluten to induce the gluten sensitivity. And we're really excited about the details of it, and it's way down in cellular biochemistry. So I'm not going to go into all those details here. But the take-home is interesting—is that that CXCR3 receptor that I mentioned that gliadin binds to, and which is also the one that unzippers the tight junctions, is radically upregulated by glyphosate. And so that's why in the last 20 years we've suddenly seen this huge explosion of quote unquote gluten sensitivity. When in reality what's happening is our gut lining is getting hypersensitized to plant lectins because of the CXCR3 receptor rising up in completely abnormal amounts. So now if you eat a piece of bread and the gliadin goes across it, you get this over-hyperstimulation, and all of the tight junctions unzipper, and you get this unregulated gut permeability. And so there's this huge synergy, and we published the paper on the synergy between gluten and glyphosate almost two years ago now, I think. And you can find that on our science website. But that relationship, I think, is really telling us something about when you throw a manmade chemical in the environment you're gonna have unexpected impact on how the body is able to handle nutrients and nutrition that it's been handling for thousands of years. So it's a big warning. But the second thing glyphosate is doing is not just sensitizing the gut lining; it's also of course, as I just said, functioning as an antibiotic. It's destroying the microbiome and your gut. It's destroying the microbiome, unfortunately in the soil and water systems. And so if you now take a look at worldwide impact, it's laughable the impact of physician contributions of antibiotics when you start to think of glyphosate. For example, if you look at just pounds of antibiotics right now, physicians in the United States are prescribing about 7.7 million pounds of antibiotics a year. That's a disgusting reality, and it's embarrassing, and we shouldn't be doing that. However, 7 million (7,000,000) pounds blushes in comparison to 2 billion (2,000,000,000) kilograms of glyphosate. And so we are so vastly being dumped on by this antibiotic, which unfortunately is going not just into our bodies but into our food itself. And so we're destroying the soil from which our food is growing at. This has very interesting implications for the nutrition within the plant. I just gave you a picture of the impact on the gut and its ability to handle nutrition. In a moment when the timing is right, we'll move to the food industry.

Brendan [29:19]: So the ... also, I wonder, is the reduction of biodiversity in our gut also playing a role in our ability to resist things like the gliadin, the imbalance in gliadin? Or is it just primarily the glyphosate creating this situation in combination or without gluten? Either with gliadin and gluten, or not?

Dr. Bush [29:47]: Perfect. Yeah, absolutely true, for a couple of reasons. So when we start to kill the microbiome, there's a number of bacteria that are pretty good at shooting up the glyphosate, actually Roundup. And we're now we're lacking those. And Roundup's like in competition and is killing the very organisms that could digest it, you know. We've got that reality of OK, we're getting less and less good at breaking down glyphosate. But then on the other side of that equation, if we look back towards gluten for example, there's eight different major protozoemes, these huge enzymatic processes that happen in the gut when it comes to plant lectins. And if you have the right sequence of these protozoemes that are being made by the microbiome and in cooperation with the human gut lining, then you can break down gluten and gliadin very effectively. And, and if you don't have the right protozome mix, then gliadin ends up getting overexpressed. You got too much of the gliadin break down stuff, so absolutely as the microbiome collapses, we can't detox, we can't metabolize normal food, we can't do our normal composting process. We can't break down the food into that compost that would become the communication network that would then go and affect the human genome to create more protein structures like the tight junctions and all this. So it's like almost at every single layer. And we can't of course deliver nutrients to the mitochondria, so you're losing cell repair at the human level. It's just this cascade of events from the

microbiome outside your body, all the way down to the tiny nucleus of the cell, all the way down to the atomic structure of water inside your cell. Like it's just this horrible cascade that's going on, and it's why we're seeing what we're seeing. I mean, from a science standpoint, it should be ... it was unimaginable that we would have the disease burden on the planet that we do today in 1980. One of the huge successful reports that's ever come out of the government was from the Carter administration. Believe it or not, Carter's administration was amazing. But one of the things they did, and they never got much news about this, but they wrote something called the 2000 Report. And they brought together academicians and scientists and thought leaders from around the world, and they wrote a single report on what would be the challenges that would face the world in the year 2000. And that paper—I think it's probably available publicly online still—"The 2000 Report", Carter. That predicted just about everything you know—global warming patterns, water shortages, worse storms, a shift in currents and tides, all kinds of things that were just for most of us, unforeseeable ... fuel changes, fuel shortages, changes in the coal industry ... foresaw everything except it had no inkling that we would have a disease epidemic like we have today. And that's where they missed. And that's why the economic modeling of the 1980's completely collapsed by the end of the 1990's into the 2000's. We were losing any sense of reality because we hadn't predicted that such a huge part of our GDP was going to be pouring into healthcare. And so we really missed on the big kind of forecasting of the economic models and stuff like that. The reason we missed is nobody could understand how human biology could collapse so fast. We went from, you know, one in 5,000 children with autism in 1975, which happens to be the year before we had Roundup ... and so 1975, one in 5,000 children. Today we have one in 40. That's ... that's in such a short period of time. In just 35, 40 years we've developed this epidemic. And we're looking into 2035 now, which is only shockingly 18 years away here. In the next 18, 17 years we expect to see autism rates in the one to three to one to five children. That ... that's unsustainable. How is human life collapsing where our children, which would be the most resilient healers on the planet and always have been, how can they be failing to heal at such a young age? And so it's just an unimaginable thing from a science standpoint, and it doesn't make any sense until you back up to this level that we just talked about. You screw up the microbiome. You have collapse of nutrient in the plant food. You collapse the nutrients in the food. You have collapse of bacterial biome in the human gut. You lose the protective membrane in the gut lining. You overwhelm the immune system. You shift from acute inflammatory capacity to chronic inflammation. You then shift to dehydration within the cell, mitochondrial collapse; the mitochondria can't make redox molecules. You have collapse of hydration within the nucleus. The DNA can't hydrate. You get abnormal micro-RNA signaling there; you get protein collapse there. You can't build a human body! And that's what's happening. We literally are losing the ability to build a normal human body. And so that's happening at the foundation of life which is of course in the soil. And so that's, that's what we're doing as humans, and we're likely not to survive that unless you guys here at Eat4Life (Eat4Earth) and all these summits that are coming out around the world ... and unless we really start to communicate as humans and say we have got to do it completely differently. We've got to change everything right now, if we're gonna survive. Certainly, if we're going to not lose generations of children to really, really unpleasant suffering. And so we really need to correct things like yesterday. And so it's really not time to be looking for ... to our legislation; t's not time to be looking to our politicians. It's time for us to look into our communities and our neighborhoods, into our backyards and say, what can we do to make a radical grass roots change?

Brendan [35:32]: Fortunately, you've at least for us on a personal level, and I really appreciate your comments about the ... we'll get back to it if we have time, or that might be for another conversation about what we can do on the grassroots level, but I want to also talk about what we can do for ourselves individually right now. And you've created an amazing product that I've started to enjoy just recently. I'm on my second bottle. It's called

Restore. And you've got this product helping to recreate balance in our intestinal, our internal—it's not just intestinal—our internal soil and microbiome. Can you tell us about what that does and how it ... you've talked about kind of how it could work by talking about these redox molecules, but you've got that now in a product. So how does that work individually for us?

Dr. Bush [36:27]: Yeah. So you had mentioned earlier that we were going to fossil soils, and that's exactly accurate. And so we're going to a fossil soil levels there. Did I lose you there?

Brendan [36:39]: No, I still hear you. I heard a system sound, but ...

Dr. Bush [36:46]: I just wanna make sure you're still with me. The fossil soils ... so we're going into the fossil soil, and what we're doing there is really relying on an ecosystem that really doesn't exist anymore on planet Earth. The amazing thing about the soils that we have today is they are nowhere near resembling what existed around the time of the dinosaurs, for example. And so if you go back to that time period, plant life was massive. We had ferns that were nearly the size of houses. We had animals like the Allosaurus and Brontosaurus, which were many times the size of the modern elephant. And they were plant eaters with a tiny little head at a tiny little jaw, and so they were not consuming massive amounts of food. It looks like they were probably consuming not much more than a horse would be consuming today. And yet they were supporting a biologic body that was massive. And so they had a nutrient density in that soil, in that plant life that we just have never experienced in our human lifespan or human history. And so it's interesting that our planet itself has gone through decrements of nutrient diversity and microbial diversity in its history before we even showed up. But now if you look at the last 50 to 60 years is we've really introduced billions and billions of kilograms of a toxin that's destroying nutrients within the soil, and the microbiome there, you start to realize that we're really hard-pressed to find intelligent soil. And so we ducked back into that fossil layer of soil. And we're extracting that from the deserts of southwest United States. And then we go through a catalyst process here in our labs in Virginia to get the hydrogen bonding right. So when we pull it out of the soil, actually none of these carbon molecules are really doing anything. They're very inert because they've been there for 50 million years. They've lost this ion exchange capacity, so we take it through a catalyst process, which is basically just taking it through an organic kitchen. And so what you're doing is you're exposing it again to micro mineral environments that will help balance out that osmolality, the pH, and the hydrogen oxygen binding capacity of those carbon molecules. And then we get a finished product, and that finished product Restore has got this really nice interesting phenomenon where it's maybe one of the first supplements ever to do nothing. Like, it has no intention of hitting a receptor in your body to do something in particular. It's not like vitamin D or vitamin C or a multivitamin where you're trying to do all these steroid effects. You're trying to hit hormone receptors. You're trying to do all this stuff with the vitamins on a normal shelf in your supplement store. Restore is vastly different. Instead it's just putting a neutral communication network into play. It's just being present, and then the cells are then utilizing that to send out whatever signal they're trying to manifest to either signal normal natural cell repair, cell turnover, mitochondrial metabolism, protein synthesis at the DNA level. We're basically helping just put the whole system back online. It's very similar to your cell phone down at the cell level. So your cell phone always works. It's got a computer in there that can receive and transmit signal. But if it's further than seven miles from the closest cell phone tower, it's pretty much useless. And so it will start to decay. It will start to fragment its software. You know, within months of not touching the bigger network, it'll start to not function well. Same thing at the cell level. If it's not tied into that big wireless network, you're going to start to see dysfunction over time. And so as soon as you put the communication network, it's not doing anything particular. It's not healing anything. It's not trying to fix anything. It's just being there to let that whole system come back online. And that's what we get to see over and

over again. It's become, you know, a major foundational piece in over 2000 clinics across the country now. And it's so interesting for me to travel around to some of these clinics because they're doing vastly different things you know. Physicians are all practicing different areas of medicine and doing all kinds of different things and they all have different reports of what they see it doing. Well of course it's not doing anything. What they're seeing is in their little niche or their prism of what they're looking at in human health. Things are changing because there's a communication network back in place, and through their prism of whether they're looking at the lungs or the heart or whatever they're looking at, they're seeing improvement because the heart is simply starting to do what it does best, which is heal. The blood vessels that they're looking are starting to heal because that's what they do. That's what a kid does. A kid is born, and it starts healing immediately. And it's constantly being damaged by exposure to the sun or a drink of water or drinking breast milk. You know, all of this stuff is doing damage, and the kid is healing, healing, healing. So we're healing machines, and Restore has been a fun thing to realize what a miraculous thing that the soil and the microbial life has really got this intelligence that's giving human life its infrastructure. It's giving human life the ability to do what it does best.

Brendan [41:32]: And so, Restore, as I understand it re-regulates zonulin. Is that correct? Which is the, our own, our own signaling molecule, I guess, that we use to open the tight junctions but in moderation appropriately.

Dr. Bush [41:52]: Um, yeah. So again, it's not doing anything to zonulin directly. It's an indirect effect there where ... so there's four major functions, and there's a video that I think is down right at the moment, but it'll be up in week or so, back up on the science website there, [restore4life](#). And I'll take you back through this if you don't memorize all this right now. But in a nutshell, there are four major functions that we've proven out in the labs. And so when you put the communication network into play, what happens to the human biology? Number one, you get really huge microbiome shifts. This isn't quite human yet. So you get a shift of the really healthy genus of bacteria which are called *Bacteroides*, or previously *Bacteroidetes*, and *Bacteroides* is that huge kind of anti-inflammatory family of a bacterial microbiome that is going to help do complex carbohydrate digestion, micronutrient processing, anti-inflammatory, antioxidant production. It's a huge, powerful thing. So in our current clinical trial, we're showing this huge shift within two weeks of being exposed to this communication network, the gut starts making a lot more of these, and it decreases the amount of Firmicutes, which is the other big genus. And those tend to be the fermenters, the acidifiers, and they can ultimately be inflammatory if they're out of balance. So we see this very beneficial shift from the *Bacteroides* to Firmicutes. So that's kinda step one is get a beneficial shift the microbiome and let that microbiome start to take care of itself. It'll start cleaning up its own weeds. The typical weeds you see in the garden of the gut are things like *Klebsiella*, *Pseudomonas*, *Clostridium*, *Candida*. These, if they appear, are not the problem, like we just, we spend way too much time to try to kill *Candida* for example, and things like that. We shouldn't be killing it. We should just be trying to foster a healthy soil so that those weeds become superfluous and they're not needed. And that's what we see happen. So whether it's the *Bacteroides* goes up, you see the weeds disappear, and you see that balance happen. So step one, very different than a probiotic, which again is just giving three or seven species of the same bacteria over and over again and never going to create that huge rich, 30,000 species organic garden. So very beneficial shifts there. Number two, it has a direct ability—and we don't know all of the mechanisms yet by which it goes down to the human cell nucleus and does the DNA shift—what we're showing is that the DNA shifts into this very high-speed protein synthesis of the Velcro. And so we see this really strengthening of the tight junction system so that when zonulin is produced, the whole thing doesn't fall apart and makes it very resilient. And you're always making new tight junctions; and it's a very quick response system. And so zonulin still functions. It should still be there. But now we've got a really good response system to that natural zonulin environment. So it's up-regulating the whole zonulin cascade, so it's in balance again. We've also shown that it decreases CXCR3, which is that

receptor that grabs gluten, so it's going to counteract that glyphosate effect of up-regulating that CXCR3. So we're seeing this huge counterregulatory factor antidote type effect to that Roundup touch. So, a beautiful thing. And you can see those slides where we're showing the gut lining with and without that communication network in play. You can see it resilient or falling apart in the face of small amounts of glyphosate. And so those are the kinds of pathways that are in the first two. The number one of microbiome. Number two, tight junctions, strengthening the zonulin pathway. And number three, a direct effect on the immune system, sitting right behind it. We see almost a 10-fold increase in glutathione, which is the main antioxidant that your body makes within just minutes of introduction. And so a huge explosion of glutathione is very unique, in biology. You can get glutathione supplements. If you go to a functional medicine clinic, they might give you an IV of glutathione. That last seconds to minutes in the bloodstream. At best you're getting a four percent increase in total body glutathione. Here we're seeing this massive endogenous, from within, because there is no glutathione in Restore or anything we're doing. From within, the microbial life is telling the immune system, "Rev up. Get the antioxidant going." How fascinating that the bacteria are actually preparing the immune system for life itself. And so the huge explosion of glutathione. So that's the third piece, is support the acute inflammatory pathways in that big, powerful, inflammatory thing that makes you stronger, not weaker. Acute inflammation is very good for you. Chronic inflammation, bad for you. Acute inflammation is really critical. So we're helping modulate and support, a healthy, acute inflammatory immune system. And then the fourth thing that we've shown is that it's talking directly to the mitochondria, and it's helping reduce the stress of mitochondria in healthy cells. And it's up-regulating the ability of damaged cells to get a reactive oxygen species burst out of the mitochondria to say, "Help! I need help. I need help." So it's up-regulating the help signals, and it's down-regulating stress in the healthy cells. So really exciting four kind of levels that were showing support to through that Restore in the human biology.

Brendan [46:54]: Wow. And there's another piece of this whole puzzle that I'm curious about. I wonder if you can say more about the so-called shikimate pathway. What is that, and how does that affect us personally in this matrix of bacteria and these lectins and this toxin, glyphosate.

Dr. Bush [47:11]: And this is a great question to wrap up with. I mean, it's so, so interesting. So here you guys are having a summit on soil. And you know, 2 billion kilograms a year of a chemical are being used that blocks the shikimate pathway. The shikimate pathway is a series of enzymes that exists only in bacteria and plants. Doesn't exist in humans. That pathway is responsible for producing the ringed amino acids ... and so the aromatic ring amino acids which are the building blocks for protein in the human body or any multicellular organism. And so think of the amino acid kind of like the alphabet. There's 26 amino acids, and each are kind of like the letters of the alphabet that you could make hundreds of thousands of words out of 26 letters. Well we make hundreds of thousands of proteins out of those 26 letters or amino acids. And so unfortunately, we've got a chemical now, glyphosate, that's blocking the ability to make some of those essential amino acids that we can't make ourselves. We have to get them from our food. And so we're blocking the ability of soil microbes and the plants themselves to make these critical building blocks for human protein and human life. So that's ridiculous enough on its own. I mean, that's enough to destroy human health right there. But then while human life is suffering from a lack of building blocks, the shikimate pathway also was supposed to be making our medicines. And so, you know, back to the very beginnings of medicine as we know it, Hippocrates a couple thousand years ago said, "Let thy food be thy medicine." And some 2000 years before him, Chinese medicine said, "Let thy food be thy medicine". So for four or five thousand years, physicians and scientists have been recognizing that nutrients in the food can heal anything. And the medicinals that are in the food, the anticancer effects, the antihypertensives, the antidiabetics, the antidepressants, the antianxiety, the neuromodulators that would prevent seizure in autism,

things like this, all of those medicinals that are in the food are made by the freaking shikimate pathway. And so we are blocking the ability of the food to produce medicine. It's the most ludicrous plan, unless you're a drug company. Then it's a brilliant plan because now you have a whole society that's living on non-nutrient, non-medicinal food that's obviously going to develop high blood pressure, high cholesterol, diabetes, major depression, insomnia, all of these things because the food doesn't have the nutrients that would've blocked those things from happening. And so now they need drugs. Well, we did the same thing to the plant kingdom. We made the plants weak through the use of this stuff. They have weak immune systems. They started to suffer, and so we made herbicides and pesticides and all this stuff to drugify farming. And so we've drugified farming. We've drugified human life. We have pharmaceuticalized the whole thing from gut to stern, and it's time for us to just take back the revolution here. And we created it. This is not a conspiracy theory. We literally created Monsanto. We as consumers created factory farming. And so this is why the grassroots revolution is so easy. All we have to do is start doing something again about food and about our own soil in our backyard. And so if you're going to do one thing this week, go out in your backyard and start planning your Spring garden. We're at a perfect time right now for you to have a few months to like learn how to plan a little square foot garden. If you've never planted a garden before grab something like *Square Foot Gardening* or any one of these little books that shows you how to grow, you know, a four by four square and which plants you should put in there for the easiest garden to maintain. A tomato plant, basil, and a couple of peppers and squash plant are a good start. So if you got that going next Spring, you are part of the revolution. In 1945, we were growing 45 percent of our food in our backyard victory gardens. That's amazing because now we're growing less than one thousandth of one percent of our food in our backyards. We have completely checked out of the food production industry, and we've said, "Go for it farmers. Go for it Big Farming. You guys produce our food." We would like to go to a Trader Joe's or something like this and buy a zucchini wrapped in plastic and take that home and pretend we're eating vegetables. You know, like we have got to reengage the nutrients, and to do that you actually have to touch the soil. You need to be part of the process. And I guarantee you are going to have a different experience eating a salad that you grew. It's going to taste different. The tomatoes that I just brought to the party the other day, everybody's like, "Are those tomatoes?" I had them chopped up, and they were in olive oil and vinegar with just salt and pepper on. They were so red that nobody could even believe they were tomatoes. And so we aren't used to seeing real food on a plate. And so the confusion that happens when you see real food is exciting. If we get back into the nutrients that are in real food, we're going to heal the world, and we're going to heal our families and most of all our children. And then they get passionate about it. And I'm very excited for my children's generation. My kids are—my son's almost 20, and my daughter's 17—and I watched their generation, and they're excited about being engaged at that level. Like they, they are so uninterested in being part of the machine, you know, doing the things with the factory farming and everything else. They're very interested in getting back into kind of a, you know, an agrarian type lifestyle where even though they're engineers and performing arts, they're interested in being a part of eating real food, of watching stuff come into a farmer's market or participated in a CSA, so that their generation is really engaged, and that's really exciting. I think that if they don't yell at them, then we're really screwed. So their generation and the generation coming up behind them are going to have to have the answer which is communicate together as humans, start to communicate and trust the microbiome and care for it and not fear it and really nurture that microbiome back into our lives. And this doesn't have to be through your food. Remember that much of the bacteria that is introduced to your body is breathed. And so get outside and breathe fresh air. If you spend all day in a drywall box that's air-conditioned, and you then go out and get in an air-conditioned, plastic car, drive home, get in another air-conditioned, drywall box. You're not breathing any healthy microbiome. And so you're seeding your sinuses that are then going to seed your gut with a bunch of Firmicutes, abnormal weeds, a really toxic environment, weird

fungi that are growing in the in your air ducts. Get outside. Just touch the soil for a few minutes at the end of your workday. Take off your shoes. When was the last time you felt grass between your toes? It's ridiculously fun. I mean you like lose 10 years off your age immediately. Like, it is something you might actually giggle, this feeling, the feeling of grass between your toes. So kick off your flip flops, kick off your shoes, get into that soil, and touch it, and realize how long it's been since you touched Mother Earth. And then start to think about the billions of ways you could work that into your day. Take a five-minute break at lunch. Get outside. Literally wrap your arms around a tree. One crazy thing, and this is probably a really bad public health recommendation to make globally, but in a rainstorm, go and hug a tree. A Native American friend of mine showed me this recently, and it's just ridiculously cool, and it doesn't happen all the time, so don't give up if you don't hear it the first time. But when there's a big storm going on, and it doesn't have to be pouring or anything like that, but there's a lot of energy and ionic charge in the sky. If you go to the biggest tree you can find, wrap your arms around it, and put your ear to the bark of the tree, and listen to the tree. The tree can sing. It can actually get an audible vibration going through the tree from that huge ionic environment. Listen to that thing. It gives me goosebumps just to even explain it to you right now, but I mean it's so cool, all this stuff we're missing. You're not getting in your day a touch of Nature, I think. And so you and I have the opportunity to push each other to new experiences of "Did you hear a tree yet? Have you ever heard a tree talk to you or sing to you in a rainstorm? Have you ever felt rain on your, on your shoulders when your toes are in the grass. Have you smelled that soil, you know, getting hit by that rain?" So that's what I think we're all here in this summit together to celebrate as we have a Nature that has been gifted to us. We're floating on a little blue marble in the middle of black space. It's ours to help, you know, really be a part of a community that powers to help nursemaid it back into health. And if we do, it's going to welcome us so quickly. The grace that's in the soil from 50,000,000 years ago. What crazy story that I just told you. 50,000,000 years ago, Mother Earth planted an antidote to an insane chemical that we would kill her soils with 50,000,000 years later. I don't understand that kind of grace. I don't understand why the humans had been allowed to survive as long as we've been allowed to survive, but we must be important to something that we've been kept here as long as we have in our insanity and in our isolation and loneliness. I think Mother Earth is literally just begging and groaning for us to enter back into communication and a celebration with her. So let's do it together, and let's continue to teach each other. Thanks for listening to all my words.

Brendan [56:47]: My goodness, Dr. Bush! You ... it's such a gift to us to have such a brilliant mind in such a ... in a body with such a beautiful heart.

Dr. Bush [56:47]: Thank you.

Brendan [56:59]: Thank you for ... and you're such a gifted communicator, and you just made me cry. So, you know, I love the Earth so much. That's why I'm doing this. And to have somebody who can bring so much together in this science to the, you know, reconnecting with the community of Nature. And you know, maybe that's why we're here is we can actually help Nature thrive even ... it's hard to imagine even more than it would naturally without interference ... but there are ways that we can work with Nature to create such bounty, and you're leading a big part of the way. So thank you. Thank you for your leadership and your contribution to the world at large and to the Eat4Earth community. Thank you for being here.

Dr. Bush [57:49]: Thank you guys for what you're doing. I'm just very excited that there's a community joining around your message and are consuming this education. All of you are going to become an epicenter with the education you're getting from this whole series. So very excited for each of you to go out with all that information and become your own epicenter of truth and change. So thank you for participating in that revolution.

Brendan [58:09]: Thank you Dr. Bush. I'm looking forward to our next communication, our next conversation for sure!

Dr. Bush [58:14]: Thank you for having me on.

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