Soil Health, Intercellular Communication and Their Effects on Human Health: A Special Interview With Dr. Zach Bush

By Dr. Joseph Mercola

JM: Dr. Joseph Mercola
ZB: Dr. Zach Bush

JM: Your health is in large part determined by the health of the soil. I know that may seem astonishing for some of you, but we're going to dive deep into why that is. Hi, this is Dr. Mercola, helping you take control of your health. Today we have the great privilege of interviewing Dr. Zach Bush, who is, in my estimation, the smartest physician I've ever met, just brilliant on steroids, essentially.

He's triple board-certified – internal medicine, palliative care and endocrinology. He has done some incredible research, just innovative, incredibly innovative. We are just delighted to have him today. One thing I can assure you with a high degree of confidence, you'll love this conversation. Welcome and thank you for joining us today, Zach.

ZB: Dr. Mercola, thanks so much for your time and having us on.

JM: Okay. You have an interesting journey. You were a conventional cancer researcher funded by the National Institutes of Health (NIH) up until 2009, and pretty much embedded in the traditional conventional medical model. Maybe it was 2008, but anyway, your funding got cut because of the challenge with the financial collapse in the secondary real estate industry in the United States and NIH restructuring their funding. Why don't you discuss your transition? Because I think that's a really important process of how you came about some of the concepts that you developed.

ZB: Sure. Absolutely. Yeah. [I was] definitely allopathically trained from the beginning, University of Colorado Medical School. After that, I went to University of Virginia (UVA) for my post-graduate training and subspecialties of internal medicine and endocrinology metabolism. During the endocrinology metabolism fellowship, I was doing a lot of cellular biology research, looking at novel mechanisms by which cancer cells can kill themselves. This is novel, at least at that time. Now, it's become kind of a mainstay of how we think about the future of cancer management.

We've always seen it as this kind of battle between the immune system and the cancer cells. Can the immune system find the cancer and kill it? Well, if there's enough cell-cell communication going on, the cancer cells should recognize their problem and commit suicide. We call that apoptosis, which is this kind of programmed cell suicide that happens once the cell reaches a state of damage that it can't repair.

I was kind of in these two halves of my brain, if you will. Under the microscope: super, super left-brained, highly analytical, studying all of these kind of almost in-the-weeds protein pathways

on cell signaling. Then over in clinic, I'm dealing with the macro problem of one of the most extraordinary explosions of disease this human planet has ever seen. We were seeing this explosion of type 2 diabetes, obesity, metabolic collapse, cardiovascular disease and of course, cancer. The clinical environment was much, much different and a lot more right brain, creative needs in that clinical environment where you're trying to do troubleshooting all the time.

It ended up being patients that ended up kind of changing my 17 years of intense academic training in cellular biology. I started really thinking, you know, there's got to be a better mechanism by which to do this. A lot of this is just the journey of any physician. We go in with such excitement into our training. We have such altruistic expectations and beliefs that we're going in to really help humans be healthy, heal disease. We're going to be equipped with all of these incredible pharmaceutical tools, incredible technological breakthroughs, incredible imaging and diagnostic skills and technologies behind us. We are so empowered. We are so heady.

Especially when I was training in the 1990s, we thought we were just around the corner from personalized medicine, where we would just pull a hair or do a mouth swab, send off your genome and know exactly what diseases you're likely to have and which drugs would work to treat them. It was a heady time. Unfortunately, it was the beginning of the end of Western medicine. I didn't know it yet.

What was happening in clinic was that now we were seeing this huge epidemic disease. Here, I was an endocrinologist, a specialist in metabolic disorders like diabetes and the like. I was using more and more pharmaceutical drugs to kind of tackle this problem. Any physician who's equipped with these big powerful tools and then employs them, it doesn't take long to start to realize there are huge downsides of the pharmaceutical approach. There are huge limitations to our efficacy. There's enormous toxicity.

It was really that journey of finding out my patients were looking great on paper – blood sugars would come down – but they were getting worse clinically. More edema, more weight gain, more fatigue, more depression. Every ounce of insulin I put them on was more disease. It was just this Catch-22 situation. It was my patients that started to help me out of that trap or out of that box that was, as a human being, starting to get me very depressed. It was really these root cause questions my patients were asking that I felt incredibly unequipped to answer.

I had been a chief resident, top of the teaching heap in academia. I thought I knew all of the minutia you could possibly know on diabetes. I trained at the third best program in the world. My goodness, I was at the top. Yet when they came and asked, "Why do I have type 2 diabetes?" I would go into this detailed description of fat in the liver and insulin resistance. Then they would say, "No, no, no. Why do I have type 2 diabetes?"

Those were the types of questions I couldn't answer because by this time we knew it wasn't genetic. There are some predispositions to it, but we know that you cannot have an epidemic of a genetic disease. [It's] impossible. We knew we had an environmental factor and I didn't know why. They started asking those tough root cause questions of "Why me?"

JM: Yes, indeed. You had mentioned the apoptosis concern as one of the signaling mechanisms for cancer. That just reminded me that's one of the reasons why you resonate so well, because I've listened to you quite a bit now. There's not one statement that you've made that I disagree with. We're just totally in synchrony on this.

Apoptosis is really regulated by the mitochondrial health. Much of what you're discussing focuses back on mitochondrial health. But I'm wondering if you can expand on how this frustration with all of these years, many years of highly educated work and failure to respond to simple questions from your patients. What was the next step in that conversion process?

ZB: The next one? I say the cracks in the glass ceiling of my world were starting to form when they were coming up with these tough questions. Ultimately, they had an intuitive knowledge that the nutrition they were eating, the food they had must have something to do with it. I kept sending them to the diabetes educators who would teach them a low-carb diet. It turns out that type 2 diabetes is not caused by carbohydrates.

JM: At least it wasn't eating a low-fat diet.

ZB: Right. Well no, it was. Absolutely. It's the cardiovascular metabolic. Go low-fat, go low-carb, which leads you with what? Protein, which is the most acidic, it turns out.

JM: Probably more toxic than both of them.

ZB: More toxic than both of them.

JM: In excess.

ZB: In excess, exactly. They were certainly eating that in excess. Some of the red flags that were going up is my patients would come in and say, "I did see the diabetes educators. I'm 100 percent compliant with the diabetic diet." Wow. One hundred percent compliant with the diet. I've never seen that. These were patients who were on Medicaid, fourth generation poverty in Central Virginia here. They were 100 percent compliant with the diabetes diet. I said, "Wow. Explain how that's possible." They would pull out their packet and there was a list of acceptable protein sources. It so happens that hotdogs was down on the list.

I had these patients that were eating, [for] breakfast, lunch and dinner, hotdogs with no buns. They thought that they were now on a healthy diet because they were eating no carbs. This was maybe the first red flag that, "Oh my gosh. What is this literature we're handing out in diabetes education?" That hotdog is even on anybody's list of nutritious foods is somewhat dumbfounding. That could somehow be interpreted as the only food they should be eating was truly amazing.

Those were some of the foundational cracks. But I felt profoundly unprepared to start to enter into that diet or nutrition conversation because I had no training in it. Seventeen years of higher education in medical science and everything else and I had a half a semester of a nutrition class in my first or second year of medical school that nobody went to because it was easy to pass by

just taking the test. You didn't have to listen to the lectures. I just was poorly equipped. I would say that's the vast majority of us doctors. Our education is so slanted away from the lifestyle and so poorly slanted towards this pharmaceutical management of chronic disease. Then really, the blinders came off.

If you're going to say, "what were the stepwise processes to get Zach from a state of in-the-trenches down some rabbit hole to some sort of 30,000-foot view of truth?" this was a major moment. What was happening as I was studying these cancer cells under the microscope and I was running late to clinic and as I was trying to get these things fixed, I got them fixed, I was staring at these cancer cells and they were invading normal tissue. You could see this incredible interface between normal tissue and this cancer just invading and penetrating through these normal tissue pathways.

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I jumped out from behind the microscope, ran across the parking lot, jumped into my white coat, stethoscope, suddenly in my doctor mode, plopped into a seat, "How you doing?" This guy says, "Doc, I've got this big ulcer in my ankle." It's a diabetic ulcer in the ankle of this guy. He takes off his boot and he's got this stinking, kind of festering ulcer in his ankle. I'm down there in his ankle for about an hour, deep reading all of this dead tissue and nothing else. Suddenly, one second leads to another second and it's like, "Oh my gosh. This looks identical to the process I was just looking at under the microscope."

Suddenly, all the blinders came off for a moment and I said, "Oh my gosh. There's no such thing as diabetic ulcers. There's no such thing as cancer. There's no such thing as disease. There's only a loss of cell-cell communication. There's only a loss and isolation and a loneliness that leads to this broken state of repair." That, I think, was a huge transformational moment for me to say, "There's no such thing as disease. There's only a lack of health." The lack of health has something to do with this cell-cell communication environment.

JM: Yes. It's kind of like an analogy that I'm fond of and have mentioned in the past: "you can't have light and darkness at the same place." If you shine a light in the darkness, darkness disappears. Light is the health. If you have health, you're just not going to be sick.

ZB: Dr. Mercola, this is why you are who you are. I mean to boil that whole entourage of words down to that, you just nailed it. That was beautiful.

JM: Yeah. It's a powerful illustration that helps people understand that. I'm grateful for it. That was an interesting epiphany that you had, this lack of intercellular communication. I opened this up with the connection between the soil and I want to go back to there in a moment, but I wanted to get the foundational primer of your experience so people could have a framework for it.

But at some point, I think someone in your clinic or your association brought out an informational pamphlet or a mini-book, 50 to 70 pages. I believe you thought there wasn't even that much written ever in the history of the world about agriculture. Then you made the connection there. Was that the next step?

ZB: Yeah. Pretty much. In 2010, I left academia. You're right, the funding for my research kind of dried up as the NIH collapsed and the University of Virginia lost its funding for the general clinical research center where all my research was based. Academia was kind of in freefall during the recession there. I jumped out of academia, much to my fear and terror. I was afraid I was never going to teach again. I was afraid I was never going to do basic science again. I really thought that was the end of 17 years of an academic career. But I knew I needed to go into this nutrition world.

I started this nutrition clinic. I wanted to do a plant-based, kind of vegan clinic. I really had a mission to really heal America at its roots. I was not interested in going to Santa Barbara, California and making Santa Barbara Californians begin. I just wasn't going to heal the world. Instead, I went to the poorest county in Virginia and started this nutrition clinic. I figured if we can make this work in fifth generation poverty, it would work anywhere. We might have a chance to change the public health tide. We started there and for the next two years, I kale juiced, pounded my poor patients with more nutrients than I think anybody [has]. I tend to go extreme when I go.

JM: Any of us do.

ZB: I was just pounding my patients with the best nutrients I could find in the garden, and helping them learn how to grow food and all this stuff. Very frustratingly, there was a good 40, 50 percent of them that weren't responding in the right direction.

There was this amazing miracle happening to the 40 percent of them where conditions of decades were just melting away under the force of nutrition. But then there was this huge percentage that no matter how much nutrition we try to bring to the plate, they were getting worse, not better. When we try to feed them kale, they get more bloated, more inflammation. Antibodies would go up, not down.

The big question in our clinic started to become, "Do we have the wrong science?" We're applying science from the 1970s and '80s around nutrients and their impact on everything from antioxidants to mitochondrial metabolism. Is it possible we've got the wrong science?

As you say, William Vitalis, my colleague who we call "the unicorn" – he's the guy who brings the magic – he brought in this 90-page white paper on soil science. As you say, that was pretty astonishing that anybody would write 90 pages on dirt. [I was] paging quickly through this, patients waiting for me in clinic. In around page 40, there's this big picture of a molecule sitting there that stopped me in my tracks.

I probably could have paged by that thing a thousand times, but this was just another one of those bumper blocks in life where the universe says, "Stop. Look at this." The blinders came down for a moment and I said, "Oh my gosh. That looks a hell of a lot like the chemotherapy I used to be making. What is that doing in soil?" That was the moment where we really started turning our attention to the possibility that there was intelligence in the soil.

JM: Yes. Maybe we can expound on that because one of the crux challenges that we face, as aside to culture, is the fact that we've been incorporating and adopting industrial farming practices for well over a century, for close to a century or coming close to a century, in using the synthetic fertilizers. That is just devastating. It's actually devastating and decimating the soil. The sum estimates are that within one or two generations, we'll have virtually no top soil left if it continues. I don't think that'll happen. I think people are going to wake up before it's too late. But we still have to make some alerts. Regenerative agriculture is a necessary component.

Maybe you can expand on the connection there with what's happening with the soil. Obviously, if you don't have healthy soil, you can't create. Micronutrients aren't there. They can't be transferred to the food, so you're going to be micronutrient deficient even if you're eating supposedly some of the healthiest foods out there.

ZB: You're absolutely right. Absolutely right. The scenario that we can look back to is that – let's go back to even before World War II. In my lectures, I often start there. Let's think about the Dust Bowl for a second. In the late 1800s, we changed farming practices. We had started to disrespect age-old practices of crop rotation, composting, soil rotation, soil aeration, all of this. We started to kill top soil in the Midwest and through the kind of [inaudible 16:53] of America.

JM: The Midwest had some of the best topsoil, the deepest topsoil in the whole world.

ZB: In the whole world. Exactly right. We had the richest biome, in some way, to work with. There are incredible rich fungi, bacteria, this ecosystem that was rivalling a coral reef or a Costa Rican jungle. There was just this massive ecodiversity in these 3-, 5-, 8-, 12-foot deep layers of soil that were in the Midwest at that time.

Then we started disrespecting the age-old of farming respect. The soil started dying. We had to put the dust bowls. We had what used to be this living soil that was fibered and connected to dead soil that was now blowing through the air and covering whole towns in dirt. It looked like Pompeii. Of course the Great Depression was happening. Everything was looking pretty desperate.

Then World War II starts, the great deal with Franklin D. Roosevelt (FDR) and everything else. That kind of rejuvenates the economy by this huge petroleum industry that got revved up, and this huge mechanized machinery of getting the war machines sped up. We were building, building, building steel factories, everything. Pennsylvania was booming. Pittsburgh was the steel capital. Everything was just boom, boom, boom town. But it didn't have anything to do with food production. It didn't have anything to do with getting nutrients back in our soil.

Then World War II wraps up. At the end of that moment, it was just a fascinating look. This is probably the most important data point we can have as consumers to take back to big farming industry to say, "You're wrong." Because they keep defending their practices by saying, "We can't feed the world if we don't use chemical farming." We're going to say, "No. We fed the world perfectly from the backyard gardens of our victory gardens that FDR and Eleanor Roosevelt pushed everybody to do during the war."

At the end of World War II, we were growing 45 percent of our American food chain in the backyard. Forty-five percent of the food chain. Now, we're growing less than 1/1,000th percent in our backyards.

JM: That's in the U.S. But worldwide, I believe 70 percent of the farms are small farms. I mean literally 1 in 2 people.

ZB: Yeah. Exactly. Those practices that they're doing were handed to them by their grandparents and their great grandparents and their great grandparents. There's this lineage. There's this complete incredible history that's really put into place there. That's just a profound environment for us to tap back into. We need to really rid ourselves of the belief that we have to outsource to these other mega farming industries and everything else to feed ourselves.

Then there's of course the [GMOs]. We'll get into the GMO story later. But let's take a look at this plant health because it so correlates and so parallels human health. In 1945, coming back from the World War, we have this huge glut of petroleum. With that glut of petroleum, we're no longer putting that into the jeeps, the tanks and everything else, and so it gets cheap. The industry needs a new avenue for that, so they create the nitrogen fertilizers from oil.

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Suddenly, instead of saying, "Hey, we need to go back to soil respect and start respecting the biome and getting bacteria back," instead we said, "Oh. This is awesome. We just dig out oil from a hundred million or a hundred billion years ago and then we spray it on our fields and then we have grain and crops." Fine, you might have grain and crops because there's plenty of nitrogen and phosphorus there, but there's not going to be any selenium, manganese, any of your trace micronutrients in the soil. You're not going to be respecting and asking that biome to wake back up and move forward. That was now the set up for the sickness of our plants.

It's so interesting that when you have a plant in your backyard or a mega farm, if it starts to lack nutrients, the first thing that happens is pests come. Those pests can come in the form of viruses, can come in the form of parasites, can come in the form of fungus and yeast, and they kill the plants. Suddenly, we have this huge demand for chemicals to come in and be antibiotics, basically, for our plant kingdom. We started spraying and spraying and spraying. Of course we've seen the same parallel in humans. The more antibiotics you use, the more drug-resistant bugs, the loss of the ecosystem, the worse the disease gets.

Then the granddaddy of them all came in 1976. To put this in context by poundage, we'll do in a minute, but I hope we can quickly convince all of your listeners that there is nothing that competes with this single chemical that came out in 1976, which is glyphosate.

Glyphosate is the active ingredient in the vast majority of weed killers on the market now. Previous to 2007 when it came off patent, it was really known worldwide as Roundup. Roundup came out in the '80s as a direct-to-consumer market. This is a very potent chemical that kills plants. You don't want to kill most plants, so it's called a weed killer. But in reality, any plant you spray with, it's going to kill.

It's worthwhile noting why it kills plants. It's not like alcohol that just simply is a potent oxidant and kills it. It's a pretty tricky and, actually in the end, very frightening approach to killing a plant. What glyphosate does is it blocks an enzyme pathway in the plant or in the bacteria that is called the shikimate pathway. These enzymes are responsible for making some of the most important compounds in food. Some of these are the ringed carbon structures that are the backbone of hormones, such as tryptophan.

If you take away tryptophan from the plant chain or the plant kingdom by killing this pathway in bacteria and plants, now the plant can't make these essential signaling molecules and everything else. It wipes out actually about four to six of the essential amino acids, which are the building blocks for all proteins in your body, which could be enzymes. They could be splaying proteins and all kinds of things. It wipes out amino acids that are going to be the building blocks for your body. There are only 26 amino acids. You take away four to six of those, my gosh, you just lost a huge percentage of biology there. But then that's just the beginning of the problem that we're talking about in nutrition.

This is, I really believe, the answer to why were we feeding all these healthy food to our patients in clinic and not seeing the health benefits. There's a family of compounds that's called the alkaloids. If you haven't ever heard of the alkaloids, it's worth a Google search. Just look these things up. As you read through that list, now imagine what would happen if we remove the alkaloids from our food. What you see exactly is the disease burst that we have going on across so many organ systems in our bodies.

The alkaloids – there's a family of them that are anti-parasitic. We have an extremely huge explosion of Lyme disease in my area of Virginia, obviously most of the country and large parts of the world. We have parasite being overexpressed. They are antidiabetic. They are anticancer. They are antihypertensive. They are anti-mood disorder. They function as mood stabilizers, antidepressants. It goes on and on and on down the list. Antiasthma, anti-eczema type of compounds.

You go through the list of alkaloids and you're like, "Oh my gosh. If we added the chemical to our food chain that wipes out all the production of this in our food, we would have just lost the medicinal quality of our food that has existed for thousands and thousands of years." It's an astonishing story of just almost —

JM: The alkaloids are a class of substances.

ZB: Class of compounds.

JM: Do the polyphenols fall in that class? The alkaloids?

ZB: I'm sorry, what was the question?

JM: Do the polyphenols fall into that class?

ZB: Polyphenols? Yeah. That would be an example of one of the chunks of families in those. These are extremely active compounds. These are right up there with redox molecules, which we'll maybe talk about in another segment. But they're so fast in their signaling mechanisms.

It's interesting, Johns Hopkins just came out with a really nice review article for the lay public recently on asthma. For the first time, we have this huge respected university saying that asthma is not a disease of the lung. What? That should be an eye opener for doctors, if not consumers.

It's not a disease of the lung. It is a disease of the small intestine. Why? Because as soon as you lack the bacteria there, you start to get this permeability of the gut and you'll lack these alkaloid factors that are coming from the bacterial biome. You are now inducing asthma from this gut inflammation. We could pick out of all of them. Cancer, heart disease, all of these diseases are really focusing in on, oh my gosh, we robbed the soil and the plant from the ability to make these essential medicinal qualities.

JM: You had mentioned that glyphosate, one of its primary mechanisms of action – it has multiple, of course – is it blocks the shikimate pathway. We're told by Monsanto and other people who manufacture it now that this only happens in bacteria. It's not a problem for us because we're eukaryotic species. Why don't you elaborate on that and explain the falsehood of that assumption?

ZB: Right, right. You can see how a marketing team can grab this and say, "Oh, great. It must be so safe because there is no shikimate pathway in humans. Except the minor detail, humans can't make their own alkaloids. Humans can't make their own essential amino acids. They have to get them from the plants that feed off the bacteria in the soil.

Suddenly you realize, wait a second, their argument is the very problem. It's the very essential nature of the idiocy that we did as a human species when we said, "We can't hurt the human." How egocentric is that? How narcissistic can we possibly get as a species and say, "Since it doesn't hurt humans, we must be good to go." Because we don't need those 1.4 quadrillion bacteria that might be taking care of us and providing all of the nutrients. We don't need those 14 quadrillion mitochondria that are fully responsible for taking all of the food on the plate and turning that into the only molecule the human cell runs on, which is ATP or adenosine triphosphate.

I have to laugh because it's so freaking sad. It is so pathetic that we did this to ourselves. It's just so myopic. It's so ironic that we thought, "We're bulletproof and we can't hurt humans, therefore we must be good."

JM: Well, I wouldn't be so quick to criticize the whole species because it was this very small group of greedy corporate individuals who really wanted to earn money and couldn't care less about harming the biology in the whole human ecosystem. But I wanted to connect some of the dots, because you had mentioned earlier about the intercellular communication as being at the core of foundational root of all disease. It really is that disease is the loss of intercellular communication. Let's tie that in to the glyphosate and how that disrupts intercellular communication.

ZB: Yeah. It sounded bad with the alkaloids, but it gets worse from there. This is a slippery slope of bad news biochemistry here. You're about to hear why I don't get invited to any parties anywhere, anytime. Nobody really wants to hear this information.

I guess let's paint one more picture before I jump into the cell-cell communication so that we can maybe paint a backdrop, because we're not trained certainly as consumers, let alone physicians to think about cell-cell communication on this level. Let me just paint the backdrop of the bacteria. We've been talking about nutrients and the lack of nutrients in our plants. Let's back up again to World War II for a moment and say, "What's been happening to our ecosystem or the bacteria that are thriving historically in our soils?" Now, we have the opportunity to either miss them or participate with them.

In the early 1940s, we discovered penicillin. Penicillin, you may recall, is derived from bread mold, which is an interesting story of ecosystem, right? If mold kills bacteria, what do you think bacteria might do to mold? If mold kills bacteria, what do you think it might do to a parasite? Suddenly you see like if we're going to have 40,000 or 100,000 species of bacteria, fungi, viruses, all of these things in concert, they're going to have to check each other's growth. They're going to have to be able to balance and do the yin-yang thing.

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Penicillin was the first thing where, again, we overlooked the profound truth here is that, wow, bacteria and fungi are in a relationship. We said, "Oh. What a great chemical. We can extract that. We'll turn that into a drug and make billions of dollars." So we extracted chemical meta-drug penicillin, which was reserved for the troops during World War II because we couldn't produce much of it and it has been going out to fight gangrene and important things. It was a big paradigm shift to be able to kill bacteria. Previous to that, it was alcohol. It was antiseptics, things like that.

JM: Or mercury.

ZB: Mercury. Yeah. I'm sure you've never done a spot on heavy metals in your show. Yeah.

This is the backdrop. We started to kill bacteria. But of course, World War II wraps up and we start to amp up our ability to make penicillin. Pretty soon everybody's getting a shot of penicillin for anything that came into the primary care doctor for. If you have a cough, injection of penicillin. You've got a sore elbow, injection of penicillin. You've got cancer, injection of penicillin. It just didn't matter. We were penicillinizing everybody. We're drugging it up.

You fast-forward now to 2011 and 2012, this is the last time I have hard numbers on the number of prescriptions given in the United States for antibiotics. By this time, and actually that line has been pretty flat. The number of prescriptions per 1,000 persons in the United States has been pretty flat for the last 10 years. That number is around 7.7 million pounds of antibiotic prescribed to Americans every year. That's pounds, not prescriptions. It equals out to over 800 prescriptions for every 1,000 persons. What? Yeah. 80 percent of the population has seen antibiotics in any given year? The answer is yes.

The reason the line has been flat and we haven't increased beyond that is you actually physically can't get enough antibiotic prescriptions into people's hands to surpass 83 percent of the entire population, because somebody was actually busy and did some work or something like that, and didn't get to the doctor to get their prescription. We've maxed out our ability.

Now, take a look at what's happening to our agriculture industry. Starting in the 1960s and really ramping up to the '80s and '90s, we've been putting antibiotics into the feed to induce stress in the animal, which makes it store fat and gain weight faster and then get to the butcher block quicker. That stress induction of antibiotics has been used for a long time now in meat production. Not surprisingly, United States wins worldwide as the most number of milligrams per kilogram of meat produced. It's pretty gross.

By 2011, 2012, we're looking at 300 milligrams for every 1 kilogram of beef. One-third of the weight of the cow is prescribed in antibiotics in some short shape or form. Disgusting. That equates to almost 30 million pounds. 7.7 million pounds for the human consumption or 30 million pounds for the cow. Now take a look at glyphosate. Currently, we're using over 2 billion kilograms of glyphosate worldwide right now.

JM: That's annual isn't it?

ZB: Annually. That number doubles every six years for the last 25. That's an antibiotic. That's functioning to kill bacteria in the soil.

JM: That was its original patent. It was for an antibiotic.

ZB: It has been patented as an anti-parasite. It's been patented as an antimalarial. It goes on and on and on. It's their recognition that this thing kills bugs. Now, of course, the disaster we have is that we're dumping 2 billion kilograms into our soils or the earth, which means all of that soil now cannot produce alkaloids. It cannot produce any of the critical amino acids or critical protein.

JM: I'm just interrupting here. For those who are not metrically inclined, 2 billion kilograms is 5 billion pounds. If you're using the imperial system.

ZB: Yeah. It gets pretty gross pretty fast. The devastating thing about glyphosate, compared to something like mercury, which you mentioned earlier, most of the heavy metals and other toxins that are in our environment are going to be pretty lipophilic. They're going to prefer a fat environment. That's going to actually keep them relatively sequestered in our ecosystem. You don't find much mercury in air, for example. It's going to be sequestered down into our systems. You're going to find some in the water, but it's not going to have a hard time transiting into a cloud.

Glyphosate, unfortunately, is an organophosphate. I didn't even mention this when we were talking about amino acids. Glyphosate is called glyphosate because its backbone is glycine, which is one of the most essential amino acids that's extremely rich in your extracellular matrix,

which we'll come back to in a few minutes. But your extracellular matrix, your neurons, many, many tissues rely on glycine as an amino acid building block. Glyphosate is glycine with a phosphate tagged on the end of it and an amine, which is a carbon oxygen compound, on the other. This whole family is called organophosphates. Organophosphate molecules are a toxin that tragically is water soluble.

This is like, for a biochemist, this is like goosebumps. This is Dante's hell opening up right there. Because if you have a water-soluble toxin that is 2 billion kilograms in the environment a year, you know it's now infiltrated every sector of the water cycle. That's exactly what we're finding. Recent studies done down in the Southern United States, 75 percent of the rainfall, 75 percent of the air samples [is] contaminated with glyphosate.

We're dumping it in our soil, goes into the water system, runs off into our rivers, some of it settles into our deep fossil aquifers that have been clean for billions of years are now contaminated. We've got all of that contamination underneath us, and then you get the mobilization of the water cycle. You get evaporation. You get clouds. You get rain. In every single part of that cycle, you've got glyphosate, which is the devastating story about our food chain again, of course.

Because as consumers, we are waking up to reality. We have got to get organic. We've got to get these chemicals out of our diet. We're eating organic food. We're doing all these stuff that we can at the grocery store. Yet, if it rained on our crop, you've got glyphosate. Now, obviously it's going to be way less than if the farmer just came and sprayed glyphosate all over right before it is harvested. But nonetheless, we have this whole ecosystem contaminated with a single chemical that is an antibiotic.

We are annihilating the ecosystem around us and our health by this beautiful checks-and-balances Mother Nature that we live in. I think this is by her intention, right? This is not a mistake that we were relying on the rest of the ecosystem for our health. Because this made sure that if we started misbehaving, we started disrespecting our environment, our health would diminish.

Now, our health is diminishing to the point where we can't reproduce. We're going to see a flattening and a collapse of the human population if we don't change directions very quickly with the way in which we are disrespecting our ecosystem.

JM: Yeah. Can you comment on the concentration that is in the average person of glyphosate? I guess there are two subgroups: the normal individuals and then those who are seeking to avoid anything but organic foods.

ZB: Yeah. You'll definitely see a huge, huge range in there. This is water soluble, meaning that it's very hard to measure by the second as to how much is in your total body because it would depend highly on what compartment you check. You could check the blood level of glyphosate and that's not going to necessarily reflect what's intercellular. It's not going to reflect what the kidney is seeing and the urine, etc. It's going to depend on where you check that.

But we can go right back to the manufacturer for this information basically, because the manufacturer has been saying the one thing you said, which is, "This doesn't have that cellular pathway in humans so it must be safe." We're going to prove that that's not true. There are other toxicities direct to the human toxicity that we talked about. But the bigger story than that, around the nature of the glyphosate and its compartments, is that Monsanto's been saying it's never bioaccumulated, which was an important piece of their safety data, that the body doesn't store this stuff.

That was reassuring to the Environmental Protection Agency (EPA) and the U.S. Department of Agriculture (USDA) and everything else. But if you looked at their data, they said, "Look, at the same rate that you eat it, you're going to pee it out." If you measure how much is in the food, you're going to see about that much in the urine.

If we take a look at the food chain right now, it's typical to be exposed anywhere from one part per million up to as much as 40 parts per million of glyphosate in a typical diet. You can say with confidence that the human body is going to have anywhere from that one to 40 parts per million of glyphosate in its aqueous environment. Now, there are exceptions to that. A desperately sad one got exposed by a non-profit.

Zen Honeycutt is I think one of the heroes of the consumer industry. She runs Moms Across America, which is a non-profit, consumer education mission-based organization out of Colorado, and just a beautiful woman in an organization with a really great passion and message. They have been asking the EPA for decades to do a glyphosate in breastmilk study.

In 2014, they finally raised enough money to do the assays themselves. They had women who were trying to stay away from Roundup, trying to stay away from glyphosate, submit breastmilk samples to the study. There were 10 women in the study. I think five of them had detectible glyphosate levels, three of the ten had levels that were rhythmically higher than ever measured in the human body before. Sadly, we were looking at 760 to 1,600 times the amount of glyphosate that's allowed in European water systems sitting there in the breastmilk.

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This is a devastating story for neonatal life in that, here you have an infant that just got born. Unfortunately in the United States, there's a 47 percent chance that kid got born by C-section, which means never saw the ecosystem of mom's vaginal canal, is born sterile and immediately adopts hospital flora, not mom's flora. You have a very narrow ecosystem in this infant, already deficient in this bacterial communication network that we'll talk about. Then you'll put it on mom's breast and boom, glyphosate. Seven hundred and sixty, 1,600 times the amount that you would see in the drinking water in a European city. [It's] just a devastating story.

Now, we can get now, I guess, into the story of what is the direct toxicity of glyphosate in that human. But am I missing any pieces before I go forward?

JM: No. It's great. It's a good story. I think everyone's hanging at the edge of their seat to hear the next part of it.

ZB: It's nice that somebody wants to hear what I say somewhere in the world. It may not be a cocktail party, but on Dr. Mercola's show, it is frontline seats. Thank you.

This was stuff that I didn't know anything about. Extracellular matrix, the whole protein structure outside of the cells was not in my purview. Here I was studying cells at the highest level of detail and I was all stuck inside the human cell. That changed once I left UVA and started the nutrition environment.

We found these bacterial communication molecules down in soil in 2012. What we then found as we started a study on the effects of this communication network in the gut environment, small intestine and colon, we started to realize that there was a direct toxicity of glyphosate that was linked very closely to the presence or the lack of bacteria. This was starting to suddenly bring a bunch of pieces of the puzzle together. The damage we were seeing had been published by other people, but we were seeing it happen in such an interesting fashion when you put it into play with bacteria.

What we are seeing as a direct toxicity effect of glyphosate in the human environment is its direct damage to a protein structure in the gut and any other membrane in the body. This protein is called tight junctions. It has, multiple constituents, multiple little proteins that make up these large Velcro-like proteins that hook together and attach one microscopic cell to the next cell. In example of the gut that starts at your sinuses and goes all the way to the rectum, you've got a situation where you have a vast amount of really trillions of cells that are making up a single cohesive carpet or membrane or shield from the outside world.

JM: Ideally.

ZB: Ideally. That membrane that is now laced together with the Velcro is your frontline of defense. Under a microscope, it gives me goosebumps on a daily basis to look under the microscope and to realize how thin a veil protects us from this outside toxic world we live in. It is a single-cell layer thick. This is many, many, many fractions of the width of a hair. It's this tiny membrane of single cells, not two or three-cell stack, one single cell patch. It's that ethereal, almost invisible membrane that's held together by the Velcro that is your frontline of defense.

The Velcro, it turns out, is loosened appropriately by biology to allow big macromolecules to come in and then it tightens up right behind that. That is managed by a little protein that we make in our own body called zonulin. Zonulin is produced appropriately by molecules that need to get through the membrane. It'll touch the membrane, the gut epithelium will make zonulin. The zonulin will open up the tight junctions. It's kind of like the doors on the side of the Enterprise or something like that. The big gates open and a little spaceship comes in and the doors shut right behind it. That's what's supposed to be at this intelligent gut membrane. It opens, allows through, closes, keeps everything else out.

Zonulin is this critical modulator of this permeability of the gut membrane. If zonulin starts to get overproduced and you can't check its production, it starts to become its own problem. It starts to lead to damage in the gut epithelium to the Velcro. Suddenly, everything starts opening up. All the gates open and everything that it was supposed to keep out is let in.

Your sinuses – think about this. In the 1920s, '30s, '40s, was everybody walking around with a nasal spray because they were all congested and had seasonal allergies? No. Nobody. Either right now or to the Philippines or to the developing world, you don't see people with chronic seasonal allergies or any of this stuff. It's because if we're not breathing glyphosate, if we're not breathing this chemical that induces zonulin, breaks apart the Velcro, then everything in the system works. We can breathe pollen all day long if the Velcro is tight. Velcro falls apart and now every breath you take, you're insulting your immune system with all this stuff that should have been kept outside the system.

It turns out that zonulin is triggered very potently by glyphosate. What a sad story because we just mentioned that Monsanto and other companies have been telling us, "Hey. It's safe. You eat it and you'll pee it out at the same rate." Oh my gosh. That's really bad news. Because now you have to not cross just the gut membrane, you have to cross the membrane of the hepatocyte, the liver cells, go from one bloodstream to the other. Then you have to go to the bloodstream. All the blood vessels are tied together with tight junctions. Now you go to the blood-brain barrier, tied together with tight junctions. That starts to leak, brain's being exposed. Then you get to the kidney, the critical organ for detox, it's tight junction.

It starts leaking. You can no longer build gradients to pull toxin out of the body. Suddenly, you're leaking at the gate and you can't detox. The body just became a sponge for toxins and you live in a toxic world. This is how we have a disease rate like we do today.

JM: That's a great story. But before we go in to tie up the story with the intercellular communication, I want you to just talk about disease rates because I've seen your presentations where you mentioned that. I think it's just frightening if we don't do something about this. We're not here to paint a picture of doom and gloom because there are solutions that we can do. We'll touch on them here. I mean we do two to three hours on solutions, but why don't you discuss the disease rates that we're seeing now?

ZB: This is so sobering. There's just no two ways about this. It's absolutely the motivator behind my whole company and all of us that wake up in the morning and go pour our energy into more discovery, turn over more stones, ask more root cause questions, because this is really the end of our species as we understand it.

Let's take the example of autism, which is probably the most stunning. But in fact, it's actually not the most prevalent. But its prevalence and the change of its prevalence is stunning. In 1975, the year before glyphosate debuted, we had a rate of 1 in 5,000 children born with autism. Right now, we have a rate of around 1 in 42 children born with autism. One in 5,000 to 1 in 42 in one generation. Technically it's two generations, but I've been alive since then. In my one generation, I've seen that kind of explosion.

JM: That's the year I started medical school.

ZB: That's the year you started medical school. In one medical career, you watched autism go from 1 in 5,000 to 1 in 42. Now, you can go to the Centers for Disease Control and Prevention's

(CDC) website and you can go to Stephanie Seneff and many others in the private sector doing the same math. But you go to any source and watch what happens to this asymptotic curve, this trajectory of this vertical curve that we're now on. What's going to happen is somewhere between the year 2030 and 2040 or 2045 – depending on whose graph you read – you're going to hit a rate of autism in the 1 in 3 range. This is a statistic that now makes it impossible for human productivity to occur.

An interesting tactic that happened in Vietnam was that they were using a small caliber bullet in Vietnam, with the philosophy that killing a Viet Cong soldier was not as helpful or debilitating to the Vietnamese as injuring that soldier. What they showed – this was this complex math that determined that how to cripple a nation the fastest was for every one injured person, it took two people to care for them. If we are looking at 1 in 3 with autism, you now have two people taking care of every autistic child. By Vietnam statistics, you just wiped out any possibility of leaving some sector that's still productive. If you just look at it from a pure financial standpoint, we have no financial solubility as a species beyond this 2035 to 2045 range.

Now we're going to waste eight years with the next presidential, senate group everything else. There is no time for us to wait for legislation. This is why, Dr. Mercola, what you do is so flipping critical. It's because if we don't have doctors out there, if we don't have scientists out there, if we don't have consumers like Zen Honeycutt, Moms Across America and these consumer groups, if we don't band together and hurry up and get this message out there, that we have to stop spraying glyphosate right now, we're doomed.

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JM: But it gets even worse, or gets even better or worse because that's a pretty dreary picture that you just painted. But that's not the beginning stages of life. We are on the end stages. I want you to talk about that. Because we have a tsunami of Alzheimer's coming. You've got all these autistic children and you have parents or grandparents who lost their minds. Why don't you expound on that?

ZB: If they're lucky, they'll live long enough to lose their minds with dementia. Unfortunately, that's looking unrealistic. If you've heard the recent news, the deaths from Alzheimer's had actually decreased in the recent four years. Why is that? They're touting that as, "Oh. This is the first good news we've had with dementia." The reason is that they're all dying from cancer before they can get dementia.

Dementia was always historically the disease of the healthy guy that lived long enough to finally have dementia. That's exactly what we were seeing. Cancer rates are exploding. Cancer Alley is the last 90 miles between Baton Rouge and Louisiana and New Orleans, that 90-mile strip. Now if you look at the entire Mississippi River tributaries in the United States, it literally grabs some 85 or 90 percent of the molecules of glyphosate sprayed and consolidates it into the Mississippi River and dumps all of that spray in the last 90 miles of the Mississippi. That's called Cancer Alley. That has the highest rates of cancer in the entire world. So, what the heck are we doing there? But it goes obviously across the country.

One in 2 males in the United States will now get cancer before they die, 1 in 2. This doesn't even count skin cancer. If you count skin cancer, numbers are absolutely astronomical. Fifty percent of males will now get cancer before they die. Women are just behind us at 1 in 3-ish. We have got ourselves an epidemic of cancer.

Of course, sadly in my clinic, I see this almost on a monthly basis now. We're seeing some kid come in with some horrible cancer – sarcomas in the bones or chronic bone marrow cancers. All of these things that used to happen in 70, 80 or 90 year old people are now happening in 5-year-old children, 3-year-old children. Not even to mention the whole brain tumor epidemic that we have going on in children.

They're trying to tell us that there's no increase in brain tumors. Well for the entire population, those statistics are barely hanging on to be true. But if you just take the children under the age of 20 and look at how many kids had glioblastoma (GBM) under age 20 in 1976 versus now, it's just like the autism scales. It's a boom. We have ourselves a disaster of cancer. Now, you can short out everything else in between the first moments of life, the first year and a half of life with attention deficit disorders or sensory processing, the spectrum disorders, the autism, to the ends of life with dementia and cancer, and then everything in between.

One in 10 kids has attention deficit disorder now. Unfortunately, 70 percent of them are medicated. It's just an extraordinary statistic. Then 1 in 4 kids now has some sort of food or environmental allergy. One in 4 has eczema. One in 4 has asthma in Australia now. Australia's actually beaten the U.S. in asthma rates. It's just one system after another, after another.

And of course the mental health one, we're now at 1 in 2. One in 2 adults will have some sort of depression or bipolar type phenomenon during their adult life. That is in contrast to a prevalence in 1900 of 1 in 100 adults. It's just a different world now than just 100 years ago. It all correlates with exactly what we started talking about, which is food, food, food. Where do the nutrients go? Where does the medicinal quality of our plants go? Where did the ecosystem go?

Now, let's just paint this all back to an amazing story of communication. This is exactly what you're doing with your show. It's get the words out there. Change the public dialogue. Let's get people mobilized together to change the industries.

What we found in 2012 is a bacterial communication molecule. There's a lot of complex biochemistry we could dive into, but I want to just boil this down to a nutshell that the word "redox" means reduction and oxidation. The simple concept of reduction is the donation of an electron to an environment. Oxidation is the tearing away or removal of an electron. The most common oxidation that you're used to seeing in a lay environment when you're not under a microscope is rust.

If your car bumper starts to rust or whatever it is, it's literally oxidizing. The water from the environment is tearing electrons off of this steel and it's oxidizing. You can see what happens. It becomes diseased, right? It's all calloused and it's falling apart. It's starting to erode itself. Pretty soon, rust becomes its own source of oxidative stress and it's destroying the metal at a very fast rate itself.

[The] same thing [is] happening in joints. Osteoarthritis, that's the rusting of a joint. We could go on down cardiovascular disease, that's the rusting of the vascular tree and all of these different systems. What we discovered in 2012 was a redox molecule potential in soil made by bacteria. This was earthshattering for my brain because all my cancer research had been on mitochondria.

Mitochondria look a hell of a lot like bacteria, but they're about 1,000 times smaller. They live inside your cells. Your cells are booming with the population of these mitochondria when you're born. Your neurons can have 3,000 mitochondria in a single nerve. The average across the whole body is about 200 mitochondria per human cell, 14 quadrillion mitochondria, just massive numbers.

Those mitochondria, when they digest your food, they make balance signaling of redox molecules. It's those redox molecules that I was studying to say, "Wow. We can use this communication network to empower a cancer cell to induce apoptosis or program to cell suicide." That was my world of cancer. I was like "Oh my gosh. Mitochondria rule the world of the cancer cell if they make enough redox molecules. If they can get a high enough oxidative stress in there, the cell will kill itself."

Then fast-forward to 2012, suddenly what is that molecule in soil? Why is there redox potential in the soil? And then of course, duh, the bacteria don't have mitochondria. Only multicellular organisms, like the eukaryotes you mentioned, the humans, or the multicellular mammal or whatever it is. We have to have mitochondria because we can't breakdown nutrients from the food by ourselves. We need the mitochondria to do that.

Single-celled organisms like your bacteria, they don't need mitochondria. They can take all that and they do their own metabolic breakdown or fermentation of whatever's in our environment. The bacteria don't have mitochondria. Therefore, they don't have all that redox singling. How the heck would they balance an ecosystem of 40,000 species if they can't talk? The goosebump, blow-my-mind moment of 2012 was, "Oh my gosh. They're talking." The bacteria are speaking together. They are in communication. They know what balance looks like. They know how to change the system.

JM: It's a disruption, indirectly if you can tie that back to glyphosate and how that disrupts your intercellular communication.

ZB: Perfect. To our shock, amazement and joy, I'm so glad to be able to tell you this is all going to end on a good note or at least an opportunity for us as humans to heal here. The extraordinary thing that has unraveled – I have to just bring up John Gildea here. He is one of the most brilliant PhDs on the planet. I have the joy of working with him on a regular basis. He's just a genius in our lab environment.

He literally, in a thought experiment, figured out everything that we've now proven over the last four years. He figured out that the machinery of our bacterial communication network that we found was going to be the antidote to glyphosate, specifically at this Velcro permeability problem. He put that into play immediately.

We did it in the small intestine, colon and all the rest. It blew his mind. It blew our minds. It changed the way we think about biology completely, because for the first time, we were studying human biology in the context of a fluid, fluent, robust bacterial communication system. We had never seen human cells in that environment under a microscope. It changed everything we believed about apoptosis, changed everything we thought about protein synthesis, genomics. It just goes on and on now.

Everything that we know about human physiology. I don't care if we're talking about cancer research, cardiovascular research, exercise physiology, human nutrition. It's been studied in a Petri dish that's been sterile. We literally do not know what the most basic mechanisms of health are in the human system, because we've never studied it. We never took into account the possibility that an ecosystem of fungi and bacteria could be dictating human cellular behavior in health.

To give you an idea of how out of control their contribution is is this new story of micro-RNA. Many of you are familiar with epigenetics. When we suddenly unfortunately realized in the late '90s and 2000s that, oh no, we decoded the human genome. But the bad news is the genes are turning on and off and making many, many different proteins based on their environment, not based on the genome.

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A single gene is now recognized to be able to make 200 different protein products, depending on its environment. This was a total paradigm shift and really bad news for everybody who was banking on personalized medicine. Because it now meant that the genome meant almost nothing. The environment was king. The environment was going to program the genes to make 200 different human bodies. In fact if you now program the possibilities of one gene with 200 outcomes and now multiply that by 25,000 genes, you're in the millions and millions and millions of potential outcomes for that human body, based on its environment.

Now, let's look at this next generation's epigenetics, and that's micro-RNA. In a classic move in science, we, as scientists, took a look at the genome and said, "Wow, we only have 25,000 genes. By gene, I mean a segment of DNA that's going to make a protein. We have 25,000 of those, guys. That sounds maybe like a high number to you. It's pretty pathetic when we thought we were going to 200,000."

JM: We thought it was a few hundred.

ZB: What's that?

JM: We thought there's going to be 200,000, but then the human genome project came in and said, "Nope. It's 25."

ZB: Yeah. We finished a little early on that project, first project maybe in human history that got done early. We thought we were looking for 200,000 genes or more because we knew we had 200,000 proteins. We thought one gene coded for one protein.

Lo and behold, we only have 25,000 genes that code for 200,000 proteins. That's a pretty pathetic number when you take into consideration a fruit fly, which was really the first genome that we untangled, only has 13,000 genes. We're only a little less than twice as complicated as the fruit fly when it comes to genes. That's pretty pathetic on some level. But it's a good excuse. If you're feeling a little airheaded and out to lunch today, just say, "Hey, look. I'm doing pretty good, considering that I have twice as many genes as the fruit fly." That's a good coping mechanism for your bad days.

But the stunning reality is that 90 percent of the DNA doesn't code for a gene that's going to code for protein, over 90 percent. We just called that junk DNA. Oh my gosh. It's just like us calling 90 percent of the matter of the universe dark matter. We don't know what that is. It may just be junk matter, so we'll call that junk DNA. Well, in the last five years, it's become obvious that the junk DNA is doing something.

Not surprisingly, it's the junk DNA that's actually regulating the 25,000 genes that actually make a protein. How does it do that? Each little strip of junk DNA makes a micro-RNA that's never going to code for protein. Instead, the micro-RNA functions as a switch. It now goes into the bloodstream and into other cells to turn on and off gene behavior.

The stunning reality of your ecosystem and your human health is that 15 percent of the on and off switch that's in your bloodstream right now is not from you. They're from the bacteria in your gut and the bacteria you breathe. Another full 15 percent are from the fungi in your environment. Thirty percent of the on and off switches that are determining what gene is going to code for what protein is not even controlled by humans. [There's] not any human source for that information.

What does this mean for us as humans? We have got to get back in touch with our ecosystem. We have got to get a complicated ecosystem back. We have got to stop taking antibiotics ourselves for sure. We need to stop eating and spraying antibiotics all over our food and soil. We have to stop disrespecting this normal balance of ecosystem. We need to start getting back outside.

Too many of us are jumping in a car in the morning, air conditioned to work, jump out, walk the 40 paces into an air conditioned office building, breathe crappy air all day. Crappy photobiology, right? All of these fluorescent lights. Everything is falling apart. Then you get back into the same car, back to the same house. You may spend a total of 10 or 15 minutes outside in an entire day. We have to break these patterns. We have to make our workspaces look different. We have to really get people back out and injecting ecosystem back into their day to day lives.

JM: Wow. That's all I can say. I suspect that is a minor reaction compared to many people who just watched this entire interview. You can understand why, as I stated in the beginning, Zach is one of the most brilliant physicians I've ever met. I can assure you, because I spend a lot of time with Zach personally, this is just a fraction of a fraction of the depth of what his knowledge is. It just is mind-blowing. I just love spending time with him because I learn more and more. Obviously, we can't give you the full details here. We'd literally take tens of hours.

ZB: It takes 19 hours.

JM: Yeah, 19 hours. It really does. You've written a book or you're in the process of writing a book. I don't think it's finished yet.

ZB: It's not finished yet.

JM: Yeah. It's called *Gut Biome*, I believe?

ZB: Yes.

JM: When do you anticipate having that available?

ZB: We hope it would be out in the summer.

JM: Okay. Good. We'll definitely have another interview before that and go over more details to help you with the launch on that because it's such an important topic. You've got so much information to share. I think the key is that you're really detailing the scope of the problem beyond what most of us even imagined it was, not just getting people frustrated and wringing their hands saying, "What can we do?," you're offering specific solutions that can turn this around, that could turn the tide, that could stop us so that we don't have to destroy the entire human species, which is literally the course we're on, unless something changes.

ZB: That's absolutely true. Absolutely true.

JM: Alright.

ZB: Thank you for getting the word out there. We so appreciate, Dr. Mercola, what you do.

JM: Yeah. We're partnering up for sure, because I learned a long time ago that you can't do this as a lone ranger. You have to collaborate with others who really have the information and are doing the hard research in the trenches, as you are doing now. You're getting incredible results. We really can't go into specifics now. But there's lots more to share is what I can assure you with a high degree of confidence. No question, we will definitely have you back for your launch of your book in the summer. Any closing words you'd like to part with?

ZB: I think your closing sentiments are spot on there. We just spent an hour talking about cellular communication and bacteria. But what we get to see in clinic is that as soon as you put this bacteria communication, we're back into play. Something dramatic happens to humans as we start communicating better. You're speaking now to the importance of collaboration and cooperation. I think all of you right now listening already feel that if we don't band together and get this thing done, nobody's doing this for us.

We outsourced our food. We outsourced our nutrition. Monsanto is the product. I think we are responsible, each of us in a small way, for what Monsanto and the chemical companies became

because we stopped doing it ourselves. We need to take back that control. How much power is that? We should be supermedially empowered as consumers to say, “Oh my gosh. With a little bit of collaboration, with a little bit of discussion, we can change everything.” That’s what we’ll do.

JM: Absolutely. Thank you for helping us understand that even if those of us who are hypervigilant and really never think that we expose ourselves intentionally to any glyphosate-contaminated food, we are getting it through the rain. There are some other specific interventions that we need to discuss in the future than can be helpful here. Thank you for everything you’ve done, you are doing, and will do. You’re a great asset to the entire community to help restore health to the world. You’re deeply appreciated.

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