Gut Connection In Chronic Illness Transcript

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Introduction and Guest Background

Welcome everyone to another another edition of mycotoxins and Chronic Illness. This is 2.0. I'm back. Today to to speak with Kiran Krishna. This is a gentleman who, has really helped and is continuing to help us get, information and validate it, which is something that as you, as we talk, you'll see, is unfortunately not very common in the world that we live in.

We're trying to bring you, cutting edge, cutting edge medicine and, lot, a lot, a lot of what we do is based on our experiences, physicians, and taking care of you as patients.

And what, Doctor Christian is doing is helping us, actually have data, so we can share this with other people. We're going to talk more about that in time.

But first, let me introduce you. And, actually tell me about how did you get into the field of, Michael of, of, not mycotoxins, but microbiology and the microbiome.

Yeah. Well, first, thank you so much for having me. I, really appreciate the opportunity to be here and be able to chat about this topic, which is really important and, so relevant for people, as they're struggling through endless, chronic issues in, in, looking at us adult population alone, you know, 50, 60% of people have, one or more chronic illnesses.

So, for me, the, the, the journey always started off as being just a very curious kid. Right? So, I was always that kid that wouldn't take anything for granted in terms of how things worked and how things functioned.

I always wanted to understand the world around me a little bit better. And so I was always curious, asking questions and all that. And so my both my parents were scientists in, in, of a sort, my mother's a medical doctor, and then my, my dad was, engineers and microelectronics engineer.

And so they each had this kind of different parts of the brain, right? My mom's the biological sciences and all that. And then my dad was more the hard physics math kind of science.

And, and he had a much more inventive side to him. He had over 200 US patents in his name, in microelectronics. And so I think I feel like I got the best of both worlds.

Maybe, I got the love for the biological science and, and then. But thinking about biological science from a systems perspective. Right. Which is where my dad came from.

And so for me, it was all about systems biology and all about how everything is connected and how everything influences, one another. But there was a significant missing piece as you go through your training in science and all that, especially when we did.

Right. And that's because we're missing this whole, component of functionality, and that's the microbes. And then we started to realize in the early 2000s that maybe there's something much more here, you know, to, to, in terms of what's influencing us and driving our functionality beyond our own genes.

Right. Because that was the Human Genome Project. And in fact, the university where I was working at the time, one of the biochemistry labs was a key lab in, the whole human genome project.

And one of the things that kept coming up that was really puzzling was we don't have enough genes to function, right? We don't have enough genetics. We seem to be very sophisticated organisms.

Right. We're at the top of the food chain, at the top of the evolutionary ladder. We've got amazing cognition capabilities and so on. We have 22,000 or so genes.

Right. And then compare that to an earthworm or rice plant that has about the same amount of genes as we do. And so then you go, well, how are we so sophisticated.

Right. And and prior to the completion of the Human Genome Project, it was estimated that the human chromosome would have somewhere around 130 hundred and 50,000 genes.

We have we have a fraction of that. Right. And so then the big question is how do we do all the amazing things we do? And hence through that was the birth of the Human Microbiome Project.

And I was already in with studying microbiology because the, the, the invisible world fascinated me so much. Right? It was either I was going to become a quantum mechanics, researcher, or I was going to do microbiology as one of the to.

I'm glad I went microbiology. And so, you know what what was really interesting to me is that as you're training in microbiology and you start looking at careers that are associated with it, a lot of the medical microbiology side are very focused on pathogens.

Right. And pathogens make up less than 1% of all the microbes that we know. So my big question always was, what about the 99.9% of other microbes? Right. We're heavily focused on pathogens.

All the time in terms of career and research and all of that. Then the Micro Human Microbiome Project kicked off and I was like, that's where the answers are going to lie, right?

Because now we're finally looking at everything else. And so for me, that became an automatic focus for the next, you know, foreseeable future in my career was getting involved in the microbiome space.

So that's kind of how I jumped in. And I was always a, a proponent of functional and natural medicine. I grew up in India, where we use a lot of I village medicine.

There's lots of herbs and things that are being used you on my grandmother and all all had lots of home remedies and things like that. So I knew that there was a power to a lot of these things.

You know, not a lot of science had been brought to where we're where they should be. And so to me, that became an immediate focus was like, okay, I want to work in the in the functional medicine space, but I want to bring in the power of the microbes to work as a tool in that.

Yeah.

What Makes a Healthy Microbiome

And what what's exciting, I, you know, the regular viewers will know that I always throw in something about, Robert Inovio and his cell danger response story.

But what is exciting is that that you navios real push these days is something he calls cell eugenics or cell eugenicist, which is how to heal. And one of his, the things that he's very frustrated with is, just, as you said, is the NIH, the National Institutes of Health, like almost all of their budget, is on pathology.

What makes us sick? And we don't focus on what gets us back to health because the reality is, when you have chronic illness, it's very rare that just removing the cause, the pathology is going to get you back to health.

The reason you have chronic illness is that system that normally brings us back to health, has gotten stalled, doesn't have the right information, and it's the natural system of healing.

And the microbiome is obviously a big source of that, something that, again, the natural past had been trying to and the, yeah, a lot of people have been trying to tell us for the last hundred years, or longer, that it starts in the gut.

But so you and you have you are one of the people who helped, not just, study, but you're helping us really get real information. Real data. So, so, you know, and so how how, at this point in your career, what do you think is a healthy microbiome?

How and how does that help us? Yeah, that's you know, that's one of the most important questions, right? Because we know clearly what is not a healthy microbiome.

We know that there are certain signatures of the microbiome associated with certain conditions. Obesity. There's a certain signature of the microbiome, autism spectrum disorders, depression, all of these things IBS have, specific signatures that are associated with the microbiome.

But when you look at what is healthy, so what is the goal that we should all strive for? One thing that just keeps popping up is diversity in the gut microbiome. Right.

And and that may be different for other biomes. Other like your skin microbiome, your vaginal microbiome, the oral microbiome may have slightly different rules.

But when it comes to the gut microbiome, which is a vast majority of the organisms live there, it's diversity and having high levels of keystone species.

Right. There are some organisms that are designated as keystone species because they're so important in maintaining the the rest of the population. They're also inversely correlated with disease to the host.

And as we lose keystone species and lose their numbers, we start to see the system dismantle and so having high diversity, having high levels of keystone species is key to a healthy microbiome.

And there's that. Are there a nice variety of studies around this as well. Right. So there's a lot of, population based studies that look at a broad swath of the population, on diversity and how that impacts, pathologies and how that impacts risks and so on.

But also, it's important that, you know, they've looked at things like human longevity, right? How long you live. It's going to be determined largely by how diverse that microbiome is.

And to me, the number one health goal that I have is not to be in some sort of perfect health or not to have perfect lifestyle perfect choices. It's about being resilient, right?

I want my body to be in my system in general, to have some degree of resiliency so that when I do abuse it a little bit, which we all are going to do.

Right, that it has the capability to handle that. Right. So when I do travel or you do have a good Friday night out with your friends as a celebration or something, right?

Or if you make an imperfect choice in your eating, your body can handle it. It can adapt. So so you don't. So you can follow the 8020 rule, right? 80% pretty good decisions and 20% you're going to do some fun stuff on the side.

And so building some degree of resilience is key. And having that diverse microbiome is a huge key to resilience. Yeah. That's that's a big difference. Right.

And when you say keystone species you know, how many have you I mean again this is is an ongoing study. But at this you know what. Where where do you feel you know, what has your data shown you is for numbers of keystone species are ones that are really, you know, that's acceptable.

I'll let you talk more about that and also how they support the rest of the microbiome. Yeah. So you know, there's really about 8 or 10 well known keystone species that can be shown to be inversely correlated with disease.

Right. Single organisms that have a huge impact on your disease risk and outcome. These are organisms like killing bacteria present inside. F that has been shown to be inversely correlated with everything associated with inflammatory conditions of the bowel.

Right? So IBD, Crohn's colitis, colorectal cancer and so on. Those are all inversely correlated. And then Akram mentioned you sent is another example, metabolic syndrome and all of the, you know, 40 or 50 diseases that fall under that whole umbrella of metabolic syndrome are all inversely correlated with this single organism.

And, you know, obesity, diabetes, heart disease, dementia, polycystic ovarian syndrome, all of these things that are that fall under that umbrella are, are, protected.

You're protected against we have high levels of Akram NCA. Then there's Bifidobacterium longo for example. And we work with the long and very unique long term that is that contains an exo polysaccharide layer on the outside.

Which seems to be a really powerful psycho biotic, which means it's a, it's a microbe that has an impact on brain function, on mood, on sleep and so on, through the gut brain axis.

So, so there's about, you know, 8 or 9, somewhere between 8 or 10, organisms that have been identified to be somewhat keystone, meaning that they, have this really important global impact on the host.

And, and what's interesting about how the microbiome is structured. Right. So when you get down to the species level, most people are different from one another.

In fact, you could have, you know, identical twins who are 100% the same genetics, lived in the same household and still have huge differences at the species level of their microbiome.

Now, one of the reasons why we can all exist and have very different distribution of microbes at the species level, and yet function in very similar ways, is that there's a lot of functional redundancies within the microbiome.

Right. You might have one type of organism that produces a lot of your butyrate. I might have another that does the same thing for me, but they're different species.

So those functional redundancies are important. However, when it comes to the keystone species, they seem to be unique in what they do. And so having those keystone species across the board in everybody becomes really important that, you know, it's much like genetics is that there are some genes that if they're off, you die before you were born or within the first ten years of life.

And then the rest were just so different. Yeah. You know, like, yeah, you know, like that. Yeah. It's and and you, you, you find this across pattern across populations as well.

Because I mean, one of the things that's frustrating is that, you know, well America we, we do have a, but but so much is aimed at, at least in the genetics world, it seems like the white Anglo-Saxon world.

Yeah, yeah, but what about in, in the microbiome? Do we have a little more diversity of of samples there? Right. So yes, across the board, you know, we do.

We have we have great sampling from many different, ethnic backgrounds and so on. But what we come to find out is it's not so much the, the, the determinations of your microbiome are not so much, ethnic or, culture or race space.

It's really geography. Geography really tells the story, right when it comes to the microbiome. You know, you take people of African descent, if they live here, their microbiome is going to completely different than, you know, their,

their family that lives in Africa itself.

Right. Because of just the different environment. And the microbes are, of course, heavily influenced by the environment, the types of food sources and all that.

But speaking of diversity, one of the things we've seen very clearly and we'll be coming out with more and more this kind of data as we, as we work through mining, all of the, you know, the thousands upon thousands of, of, sequences that we've done of, of people, and, and in fact, fortunately for us, of everyone that we're sequencing as some sort of element.

Right. A lot of the data base information that's out there that the NIH and all had put out were on healthy, normal individuals. So you can get a sense of what that quote unquote healthy norm.

Yeah. I say before, I'm quite quote unquote healthy because I when I've worked in projects, I've been amazed at how not well the controls often are, but still they're walking and talking.

They're not complaining too much. Exactly. You know, they're not being actively managed for disease conditions. Yeah. But all of our data set are people with actual serious conditions, you know, or or ones that are at least, causing them to go see a doctor or a practitioner quite actively.

And so, so we're getting a much more, what I would call a, a representative data set of most of the people that are probably listing their programs like this or going in to see their doctor for help.

Right. Because now we're starting to understand what the actual microbiomes are looking like for people that have ailments.

Keystone Species and Microbiome Diversity

And one of the and to me, the scariest thing that I'm seeing in the microbiome analysis is how low our diversity is, right? When you look at the average North American microbiome that we're measuring, we're finding somewhere around 120, 115 different species.

It's the gut microbiome. And that's scary because when you look at like the Hadza tribe or Tanzania or the Papua New Guinea tribes and so on, they have upwards of over 300 different species.

So we're we're 50% down before we start. Exactly. We've lost half of the microbiome that our ancestors really went through a lot to preserve and harbor and pass down to us.

And we have squandered, in a way, over the last generation or two, by our practices. Right. And what's scary about that is what's it going to look like 30 years, 40 or 50 years from now?

Right. What do we pass down to our kids? And and the scary part about that, and I call it a mass extinction, because it's really an important, you know, thing that we need to use a dramatic term for, because more than 50% of our capabilities come from our microbiome.

Right. And if we're losing microbes and large families of microbes, we're losing capability of being human. And and we've already lost half. And what is that half that we've lost?

What has that caused for us? Right. We don't have the data yet. But I would argue the prevalence rate of all of our chronic illnesses and, you know, birth defects and all of that stuff are likely driven by missing many of those microbes.

Right. And so, you know, it's it's equally alarming to me. And I give people this analogy to help them wrap the head around it, because it's it's so hard for people to see the importance of this right.

It's it's it's somewhat esoteric for most people. But what if I were to tell you that the next generation of kids are going to be born without a spleen because of our choices today, right?

And then they would have to go through their entire life trying to adapt and, and, and do therapies and surgery and all that to try to live without a suite.

Right. And then the generation after, they're going to be born without a spleen and maybe just one kidney, it's like losing entire organ systems when we lose huge groups of our microbes.

And so that was seen in the data, you know, and the diversity of the microbiome in a in North American population is, is is pretty scary. It's we are you've seen it decrease by age.

Yeah. So with age it goes down automatically. And a lot of that has to do with, a number of different factors. I think one, as you get older, there's more chance you've taken more and more medications.

You've been exposed to more things that that harm the microbiome over time. You know, you're drinking, eventually more glyphosate than you did when you were 15 because you've just been consuming for so much longer.

So I think all those things will take a toll on the microbiome. And they'll start to shrink. The other things that I think, affected are, you know, as you slow down and you're not getting out much, you're not going down hikes the way you used to, you know, maybe not even interacting with people as much as you used to.

So all of those things that give you exposure to microbes, those behaviors get reduced. And then, you know, the consumption and all stays about the same.

Right. And so the net, reduction in microbes occurs. Now, how diverse your microbiome is as you get older is also going to predict how long you live. So it becomes really important for people as they're getting older, as they're getting into their 50s, 60s, 70s and beyond, to really be paying attention to what the diversity of the microbiome looks like at the moment, you know, and so it becomes really important to do a test and understand where it is, and then start to really think about solutions that you can either a use to maintain your current diversity or even increase the diversity.

Yeah. You know, one of the things an aside and I'm putting in a plug for your company. We usually don't do this as part of this, but but just can you just just talk a little bit about because your, your microbiome and my, my, my we want to call but the test that you that that, your company has has put out biome pH is something I've been using for the last year and a half.

And, I said it's been an educational for me because of how clearly you lay out the different microbes that, as a, as a practitioner. I have to admit, I always found, you know, I knew the pathogens really well.

I mean, because I've been doing stool testing for, literally almost, you know, like 36, seven. No. Long time since the. That was one of the first things I did in the 80s with stool test, you know, and so those days we were really, you know, finding the pathogens, the Klebsiella, you know, and things of that sort that we knew shouldn't be over too much of.

But and then in the last ten years, we've started ever since, we the PCR technology started to come in, you know, we started to be able to get long lists of bugs.

Yeah. But to be honest, I didn't know what to do with most of that. Most of that looked to me like it was gobbledygook and it was so much information anyway.

So I like your test. Still has a lot of information, but it's a learning curve that's worth it now because you're I'm learning something from it. So. But tell me, what makes your test a little bit different than the that than the others that are out there as far as how you do, how you're identifying these species.

Yeah. So that's a that's a really important question. And the only reason why we came up and developed this test was because we were frustrated with what was being offered out there to, to health practitioners, with the microbiome testing because it was missing, the boat in many, many respects.

Right. So the first thing is most of the tests out there still use the 16 S technology. 16 S is a type of sequencing technology these days. It's very cheap to do.

You know, you could probably run a 16 S sequencing for 15, 20 bucks. And so but the problem with 16 S is it doesn't give you much accuracy at the species level.

Right. So the genus level, you can be pretty accurate that you're picking up the right genus. But at the species level it's maybe 5,060%. You just give people a little idea the difference between the genus and the species.

Just maybe we'll sort of just make it. Yeah, absolutely. So when you look at, you know, every organism on earth, we all have this, this, hierarchy of of where, where we belong on the, phylogenetic chart and every bacteria, when, when it comes down to it and everything starts with the kingdom, of course.

But then when it comes down to it, you have a genus and species, so you have genus, like for example, lactobacilli is the genus. Right. So there's many different types of lactobacilli and you distinguish them.

But based on the species and the species could be lactobacilli root awry or lactobacilli acidophilus. So the genus is that grouping that they all fall under.

But then to understand what type of lactobacilli they are, you have to get down to the species level, right? Because at the end of the day, the genus will give you some information because many of the microbes that fall under that genus will have certain properties.

But really the key functionality is going to be what species are they. Right. And that's going to determine whether or not they're pathogenic, for example, because there are many microbes that can be within a genus.

Some of those microbes are pathogenic, some of them are some of beneficial. And so, like take Clostridium for example. Right. You have lots of Australia in your body.

Many of the Australia that fall under that genus are perfectly fine and in fact really beneficial. Right. But then there's some that are pretty egregious that are going to cause you issues like C definitely Clostridium difficile.

So so understanding the species level becomes extremely important. And when you're doing 16 tests like most of those, tests are doing, you're not getting clear resolution on the genus low on the species level, you're only seeing it on the genus.

So you can't really map out what the microbiome looks like. The second part of it is the PCR that you mentioned. Right. When you're using PCR to detect for pathogens in the gut, number one, when you're using PCR, you have to know what you're looking for, right?

Because you have to put the probes PCR works by these probes. You have to add those probes into the tests. So you have to already know what you're looking for.

And if there's something else there that you didn't have a probe in for, you won't pick it up. Right? So they've just got a set of of standard pathogens, you know, knowing that there could be other ones that are present causing problems that you're not picking up.

So that in itself is, makes it often the second part of it is most of those other tests are very pathogen centric. Right. And when you use PCR, you artificially amplify the genome of those organisms.

So it doesn't give you the accurate information on the proportion of the organisms in the population. And that's the

key aspect of pathogens, because it's perfectly normal for us to have pathogens in our system.

Right? They're part of our common flora when they're above a certain threshold in terms of relative abundance. That's when they become a problem, not CFU count.

Right. So anytime these tests show you to see if you count, it's meaningless because a pathogen is only problematic if the rest of the microbes around it are inadequate.

Right. So one of the things I always tell people about microbiome and understanding the ecosystem of the microbiome is it's not just important who's there, which is what a lot of tests are looking for. Like is this bug?

There is that bug, there's this bug there. It's who else is there, right. Because it's a system. And so and so that context around the rest of the population is really important.

And to give people a little better understanding on that, on why context is important. One of the analogies I use is like, if you were a city planner, right, and you're planning out this new city and you're trying to figure out all the different departments of the city and so on, and if somebody came up to you and said, hey, there are five police officers in that city, right?

Is that enough? Those enough police officers, the first question you're going to ask is, well, what's the population? Right? If it's a thousand people in the city, five police officers, probably perfectly fine, right?

A 5000 people or even 500 people. You've got five police officers, active duty patrolling, probably. Okay. If it's a million people in the city or 500,000, it's wholly inadequate, right.

So the number of officers is not as important as understanding the population dynamics. And so when you're doing a PCR based test and you're doing the 60 ness based test, you're really only getting that kind of information like, oh my God, you have five police officers.

Well, that could be fine depending on the rest of the context. Right? So we were very big on making sure we understood the context, and we were mapping out the entire microbiome so we could look at everything from a system perspective.

Testing the Microbiome: Why Method Matters

And the only way to do that is by using whole genome sequencing, which is the, you know, advanced next stage sequencing. And it's a shotgun, the whole genome sequencing, which means that you actually go in and you blast the, the genome and you break up all the genes that are in there, and you're finding trillions of trillions of genes, and then it all gets reassembled, and reassembled and looking, and you assemble a microbes gene from beginning to end.

So you identify a microbe by finding its entire genome sequence, and then you get the most accurate and most relevant data out of it. Right. So what we're doing is, we're really changing how you can look into the microbiome.

One more quick change. One more quick addition to that is we also started really focusing on, functional groups of microbes. Right. Because we talked about earlier how you and I can have different microbes of the species level, but still have the same functionality because there are a lot of functional redundancies within the microbiome.

So instead of looking at one organism in the sulfate reducing bacteria group, for example, we look at the relative abundance of all the organisms that fall within that group.

Right. And then we give you an understanding of how many sulfate reducing bacteria you might have in your gut versus the the population of the general population and so on.

And so you have a better understanding of what your functionality is in the microbiome. Yeah. Yeah. It's it is so

important Bel and you know, because in medicine especially, you know, a lot of the people who are listening to to these programs, are they, they've had to self educate.

Yeah. You know, they've done a lot of reading. And one of the problems when you do that is that you lose the context. So people will see the name of a bug that's considered a pathogen and get panic more or less, oh my God, I've got this.

And first I'm understand saying, first of all, most of the things that that will kill you easily, or when these pathogens are maybe in a different organ, you know, if you find this bug in your lungs, yeah, it's a really bad infection, but it's in your gut and it's in a small amount.

It's just fine. It's part of it's part of a system. And one of the things in the cfa's, I believe a colony forming something. Yeah. Okay. So again, this is just a way to measure population of bugs.

And it don't want you to get confused by that. But yeah. But again, once again it's balance and understanding. Balance is not easy. One of the examples I gave all the time is that our brains are engineers by nature.

We like to think that a cause is be, you know, and we get confused when, you know, abcdef all can cause something that looks a little bit like B, right?

And that that that that's hard for us. That where our brains are, are really do well with with one cause. One effect. Right. Yeah. How medicine works and things.

And that's why people with chronic illness have such a hard time. Because that's not what's happening for most of us. That's that. That's exactly right.

And, you know, and at the end of the day, when you look at the microbes world, it becomes even more complicated than our own system. Right. Which and, of course, they are part of our system.

And so starting to be able to map out your microbiome like this and starting to understand the tendencies of your microbiome and what it tends to do well, and what it tends to not do well.

Based on the microbes that are present and their relative abundance, that becomes really important insight information for people to to start to figure out how they can, you know, improve their outcomes.

Yeah. And tens and tens, remember that word tends to affect, you know, freak when you see the wrong bug. Exactly. Yeah, absolutely. And it's so much like our own epigenetics right.

I mean yeah, just because you have a gene, if you did a 23 year me and you found a gene for some crazy rare disease, it doesn't mean it's going to show up.

Yeah. Oh, yeah. Please. You did that all the time. Or what I call or the rabbit hole of DMT for world. Exactly. Yeah. Okay. There is if there is a subset of people that that really is crucial.

But there's a lot of people that that's just part of their genetics and they have so many compensations for that. Yeah. Not a problem. But anyway, but so and so now we're bringing this around.

We're going to come back to the global stuff because it fascinates me. I, I always say this is about educating Eric as well as some of the people out there.

But but where where do you see, how mycotoxins influence the microbiome? Because you mentioned glyphosate, as you know, one of the pesticides. So we'll come back to those because we've talked a lot about glyphosate recently, but just in general, the mycotoxins that, that most of our, our viewers are familiar with.

Yeah, absolutely. So in fact, this there's good research out there showing that micro toxin exposure, especially to

food and drink and all that, because I think somewhere around 25% of agricultural products are contaminated with with.

Yeah. Mycotoxins. Right. So we're getting exposure to it. And we know that certain types of mycotoxins can create dysbiosis in the microbiome. You know, these are compounds like, you know, the alpha toxin, or toxin, deo and zetia, all of these compounds that we get exposure to, will actually create shifts in the microbiome over time.

Some of the most egregious shifts are when it really favors gram negative bacteria versus gram positive bacteria. And for for the viewers at listening that aren't familiar with that.

Every bacteria in the world can be categorized into 1 or 2 categories gram negative or gram positive. Gram positive means that when you put this particular stain on the bacteria, it picks up the stain because it has a cell wall and it's all cell wall that's picking up the stain.

Gram negative bacteria don't pick up the stain. So they're called negative when you look at it on the on the slide. The problem with gram negative bacteria is they have this component called LPs lipopolysaccharide that is in their cell membrane that LPs is a really high toxic genic, endotoxin.

Right. And so what tends to happen is over time, exposure to certain types of mold toxins will start to shift the microbes in your GI tract to being more gram negative, which means that now you have more exposure to this endotoxin that's being produced by the gram negative bacteria, which drives inflammation and leakiness in the gut in your in your intestines.

And that leakiness in the gut and inflammation will actually drive more damage from the micro toxin. Then it would a in somebody with a really healthy gut.

Right. And no leakiness. So it reduces your resilience to the microbiome. Right. So that part is really important because you can take two people. They can be exposed to the same level of mycotoxins.

And one person will feel just fine and the other one will get really, really sick. Right. And an a key difference from the perspective of the microbiome is that one person that feels okay probably had microbes in there that helped clear the micro toxin, because there's lots of microbes in your gut, the healthy microbes like Bacillus that we work with, that can actually metabolize mycotoxins when they're in the gut and get rid of it.

Or they have a dis biotic gut. And in fact, that helps the mycotoxins be more toxic. Right? So yeah, and that's all fundamental differences in what the microbiome looks like.

Yeah. I is it your their families that that tend to help suppress those maybe help your body, detoxify in a way or deal with the mycotoxins. You mentioned it. Was that lactobacillus you were talking about?

I don't know if it was just a loss for just a species. Yeah, but I was like subtilis, for example, up till, And we know this because there's been a lot of research in the agricultural space with farmed animals.

Right. So farmed animals, if they get high exposure to mycotoxins, they will die. And then, you know, farmers will lose huge swaths of their, of their herd.

And yeah, they cost a lot of money. In fact, I think mycotoxins really were discovered in the 1960s because of, contamination in farmed animals. So, yeah, I explain this to patients.

Is that most of that, most of the data on mycotoxins is on the agricultural world, because if your cow dies, it costs you thousands of dollars. Exactly.

And when people die, it causes great suffering and pain for the individual. But we don't. We just wrap that up and it doesn't get into the research funding for something.

Yeah. Which is crazy. I mean, you know, I know you have these these, trillion dollar industries like agriculture, every penny that they, that they lose on, on each animal and each crop has a huge rippling effect in terms of, the money loss.

And so they are funding research like crazy, right? The mycotoxins, you know, there was this crazy, little epidemic among turkeys called Turkey syndrome or something that went through, and they found that it was, like a toxic contaminant that that created all of this illness in birds.

And so what they started doing was looking at probiotics, to deal with mycotoxins in birds and poultry and all that. And so there's a number of research studies that have come out where they show certain geniuses like Bacillus, and they're about four geniuses.

The other ones people would never heard of because they're not, probiotic bacteria that are available, to anyone. But Bacillus became one of the most prevalently used probiotic bacteria to to reduce the impact of mycotoxins on the health and, and life span of these birds.

So there's a good amount of research out there on it. And what, what that also tells us is how important the microbiome is for resilience. Right? Because depending on the having the right types of species, the right type of diversity, no leaky gut in your in your system, you could be exposed to a micro toxin.

Deal with it. Fine. But if you're like the vast majority of the population, the people we're seeing all those biome effects stress on with the low diversity, you know, low levels of keystone species and all those people get exposed to mycotoxins.

They're going to feel very sick. And, and so that's, that's a big fundamental difference, that resilience factor. Right, right, right. Because that, that that's it.

Because we do see that, you know, so many the, the, the bacteria that we consider pathogenic, you know, are the lipopolysaccharide producing in that. Oh yeah. That's it.

You get those gut a little leaky and then your liver starts having to work harder. And you're just sad. When your liver works harder, your brain isn't going to feel as good.

It's just. Yeah. When then that, of course, compromises all your detox pathways. Right? So, when your gut is unhealthy, when you have low diversity, you have low keystone species, you have shifted to more gram negative bacteria.

The the cascading of effects work like this. You basically start to get more permeability. Right? So you've got your intestines are already permeable.

And this is all before you get exposed to a micro toxin, your intestines more permeable. You tend to recruit a lot more innate, immune cells to the lining of the gut, to the lining of the gut.

There's a constant battle going on, and it's constantly damaging the lining of the gut, the mucosa, the the the intestinal epithelium. So you've got this leakiness going on all the time that leaky.

This compromises your immune system as well. And then your liver takes a big brunt of the hit because all of those migrating endotoxins that's the LPs that's formed by the bacteria are going first to the liver.

And so the liver keeps taking hits. And part of the problem with the liver taking hits is that your bile acid pool reduces because your liver can't make enough bile because it's it's starting to become fatty.

It's starting to get to all that, all the all the hits from the toxin exposure, the endotoxin exposure. So in then in that condition when you get a micro toxin exposure on top of it, now your system's not ready to deal with something like that, right.

Because the gut is already leaky. That means a endotoxin that comes in is going to be more permeable and moves through it end up in circulation.

Mycotoxins, Dysbiosis, and Gut Resilience

Your immune system's not functioning properly, so your immune system can't help you as much as it should. The you don't have the right bugs in your gut, or microbes in your gut to metabolize it and reduce the amount translocated through.

And your liver is under a lot of stress to begin with, so it can't really help you the way it should to detoxify you. Right. And and the endotoxin is going to make your gut even leak gear because we know that, sorry, mycotoxins, we know that micro toxin exposure increases intestinal permeability.

Right. So now you're just you're going down this cascade where your body's not resilient and ready to be able to deal with it. So then the big question comes, okay, well, what if I'm already in that state, right.

What if my gut was already messed up? It was already leaky. It's all just damage. And now I've also been exposed to to mycotoxins. What do I do now? Well, just like before, if your gut was healthier and you had more diversity, you had more keystone species and all that.

You would deal with the micro toxin better. So it still becomes really important as you're going through your health journey of trying to, you know, improve life after, micro toxin exposure.

You still have to fix that component of your gut, right? Because then your gut is going to play that important role in starting to rid your body of the impact of the micro toxin.

Yeah, yeah. This is, Yeah. And removing yourself from mycotoxins exposure is number one. But if you don't heal the rest of the system because as we always tell people, you know, everybody's exposed to mycotoxins and most people do fine.

Yeah. You know, and so it's, there's a problem, but so is there a I mean, you know, I don't touch supplements in a minute. You know. You know, other than eating dirt, I mean, what what what's your other suggestions for really making sure that you can increase the diversity and maintain it?

Yeah. There's a number of things, that have been shown to be able to increase diversity of the microbiome. Number one, and this is counterintuitive, this fasting, you know, as it turns out, doing some degree of intermittent fasting, or at least providing your, your system with somewhere around 12 to 14 hours of no active food intake, can actually dramatically improve your diversity, because there's lots of microbes that actually are much more active and proliferate during periods of fasting.

You know, and what's so interesting about how you look at your microbiome is there's a cascading effect of nutritional utilization, right? So when you first eat food, lots of the fiber and things, the roughage and all that move into the large bowel because they're not broken down and digested and absorbed into the human system, into our system.

So it goes down into your your large intestine, where there's a whole series of bacteria that are really good as, as primary digesters to break down the big molecules.

Right. The big carbohydrates are big fibers and all that. But then as they're breaking those down, they create smaller molecules and metabolites. And then there's a whole other layer of microbes that only use those smaller molecules and metabolites, and then they produce even smaller molecules and more metabolites.

And there's another layer of microbes that utilize that. So when you want all of those microbes to get to feed and get to do what they do and multiply and thrive, you need a period of time where the primary digesters aren't functioning right.

So you have primary digesters and then they they produce all the byproducts, and then they take it easy and go to rest. And then the next secondary tertiary start to, to ramp up.

And that occurs over a period of, you know, 12, 14, 15 hours. And so having some degree of fasting in your system, you know, whether it's 4 or 5 times a week or, you know, once a week, whatever it may be could be beneficial.

Getting outside is really important, right? Studies show that if you spend more time outdoors in places like the woods going for hikes, kind of untouched land, right?

So, you know, walking up and down the sidewalk is not quite the same. It's about being in more of a natural environment, and being prescriptive about it, you know, I tried to prescribe myself, three times a week, 30 minutes at a time, being outside in a natural environment.

Right? So we we all know that that's intuitively we know that that's good for you. But but we have to be a little bit more prescriptive about it. So we ensure we get enough adequate time that way.

Another one is getting a dog right. Studies show that households that have dogs tend to have, people with more diverse microbiomes, kids with less, you know, pet, allergies and so on.

Right. And then walking the dog out, number one, it forces you to go outside. And then number two, the dogs will bring up all kinds of wonderful microbes, interior system, into your home.

So and in fact, in the beginning of 2020, it was kind of like the year of the pets, right? Because. Right, so many people stuck at home. So they were like wanting to adopt pets when they're lonely, which is great.

But in beginning of 2020, they published a study showing that bringing a dog into a household increase your longevity by a measurable amount. Right. So through the microbiome is likely one of the ways it does that.

So you could do the intermittent fasting. You can bring in the dog. You could also reduce the amount of sterilization in your home. Right. Most surfaces in your home don't need to be sterilized.

Worked last year, right? So, this is you. You were one of my. You know what I want to say? Unfortunately, when people become chronically ill, the basic desire, for self-protection increases.

And so, obsessive compulsive behavior, which we all have, some of, you know, I mean, everybody's got their thing, but inflammation seems to trigger that.

Yeah. And then the need for cleanliness goes up. And then on top of this, this was there. And then we had Covid, and the absolute what I consider a public health disaster, forget about Covid of people wiping their hands and washing with with only the alcohol based and other and cleaning every surface.

It makes me insane. Okay, because no, these bugs are not. That's not how you're going to get the things that kill you, right? Okay. I'm sorry, I got just it just just just makes me nuts.

You know, because it was a great book from many years ago, the epidemic of absence, you know, and, and just the lack of exposure, you know, we've got a lot more, pesticides and a lot more emfs and a lot less other healthy bugs in our existence.

And it's rather frightening. So. But one of the things I want to throw in before I go back to what you have to say is just, Doctor Pimentel, who talks a lot about irritable bowel, is he?

But I mean, his very example. If you do not, have at least, you know, a significant number of hours, you know, eight, 12, 14 hours without putting something in your mouth.

You don't get a you're cleansing waves just don't happen. And without a consultation. And yeah, you are not probably feeding those bugs in your large intestine what they really need on some level.

Exactly. You're not. And and in fact, you know, the the microbiome is a diurnal system, right. So it works off of a 24 hour clock, 12 hour phases. And part of the key is kind of getting your own circadian rhythm to match with your microbes.

And that's one of the difficulties of, of overseas travel is that your bugs cycle and your cycle kind of go off out of whack a little bit. And so one of the key aspects of that is within the microbiome, how they're there is housed a number of microbes that that turn on housekeeping genes.

And these housekeeping genes are really important for repair and clearing things. And, for example, you know, the process of, my autophagy or autophagy, this is the the removal of damaged mitochondria or damaged cells and DNA and protein and all that.

So cleaning things up, things that if left untouched would, would clutter the system and would cause risks for more scary things like tumor formation and all that.

Right. So we have to clean all that. Oh, there's a lot of damage and destruction that occurs living day to day just from your immune system protecting you.

The metabolic processes. Right. All of those leave debris. So you need to clean all that debris out. That process is triggered in large part by the microbiome, and it does so when you're when you're not feeding the microbiome, right.

When you're feeding the microbiome, which means you're feeding yourself most of the work. And energy goes towards breaking down and dealing with food.

Right? We we know that. We know that the sympathetic nervous system kicks in. We know that all the blood flows going to the gut. We know that from a big meal. How tired you get.

There's a lot of focus on it. So you can't do all of the housekeeping work and all the cleanliness work and cleaning things up when there's concern, food coming in.

So yeah, and then to put a finer point on, are there particular, other particular, geniuses, that are involved in this, you know, circadian rhythm that are so well, most of the microbes will play some role in it.

Right? Right. They do the quorum sensing, they read and speak to each other to a certain degree. But for example, at commands here at Comanche, it does a great job of proliferating and and all that in a fasted state.

It becomes active. And Comanche is one of those keystone species, right? So it becomes one of those, kind of the, the, the key element of really generating a lot of that, that housekeeping gene activation.

Right. So one of the genes that it turns on, for example, that is really important when sacraments use a lot of people are afraid is a mute gene. The mute gene is a genome that triggers our own goblet cells to start producing more mucus, to start, getting rid of the old mucus that's captured all the toxins and viruses and all the stuff that we don't want to make it inside our body and starts flushing that out and then reproducing more mucus from the inside.

Right. So clearing that sticky layer that helps protect us and protects every square inch of the inside of our body so that there are certain microbes that that are really important during that time of repair. That's really good.

And another, another, functionality of sacraments. Yeah. And I and I keep bringing that up because it's such a fascinating organism to me because we only have one species of necromancy, in our whole microbiome.

How to Support Microbiome Diversity

Right? Oh, wow. You said a filler. There isn't any other romance. Yeah. In there. So it's one of the few organisms where there's only one member of that genus.

The other thing it does is it is it takes polyphenols that have come in through your diet and converts it into your elephants. And your Olympians are hugely important set of compounds that trigger things like mitochondrial repair, cellular repair and so on.

So those your elephants are only produced for a month when Aquaman two is active and dementia increases when you're fasting. And so it becomes so important to to understand that, that when you think about eating right, we're not just eating for ourselves, right.

We're eating for this massive set of microbes that are in the system. So we need to adjust our pattern of thought on not just what's pleasurable or good for us.

As we're eating, it's it's has to be equally good for your microbiome, too. And that's why certain diets, you know, like, for example, if you decided I'm going to start bodybuilding tomorrow.

Right. So and I read online somewhere that I need to have 150g of protein a day. And so then I'm starting to just eat nothing but chicken breasts all day long.

And eggs. Right? But that's not very good for your microbiome. So even though that might help you put on mass to a certain degree as you're lifting and that's important to you, it's not good for you, microbiome.

It's going to cause a loss of diversity. It's going to cost too much ammonia production, which can actually harm for many, many of the organisms within your microbiome.

So I think we have to, as a population, start shifting our perspective a little bit to go. We're not just feeding ourselves right. We're feeding these very important, you know, guests, if you will, that are living in the system and really running the system.

Yeah. It's, it's just so important for people to have this concept that, you know, the fed state is there to build tissue. Okay, but the unfed state is when you repair tissue, because, remember, we were designed to live in times of scarcity.

Yeah. You know, and and and we have no idea probably the most destructive, element of society is the supermarket, right? Yes. You know, we if we close the supermarkets, like, in the maybe, like, two days a week, they just we might it might help, but the the the, unobstructed or un, you know, unlimited exposure.

We have to food. Yeah. To calories. Not necessarily healthy food, but just calories is probably the biggest source of of chronic illness that we have.

You know, I mean, like a degenerative illness, I mean, nothing not the infection type, but the degenerative illnesses because we don't have time to repair.

But but so but going back, are there particular foods that you think are that you you mentioned like, you know, just too much obviously too much of one type of food is not going to be good.

But I do think, you know, foods and with without, you know, not surprisingly, what seems to be really good for the microbiome and overall health is having a diversity in the diet as well.

You know, there are anthropological studies that show that our ancestors ate upwards of 600 different types of foods on an annual basis. And of course, they ate seasonally. Right?

Because there were only certain things available in certain seasons. So there. So but we have access to everything all the time. And, and our systems are not necessarily designed to eat things out of season very well.

We're supposed to get a certain ebb and flow within our microbiome, which actually helps us adapt to different seasons. Right. But but we don't get that ebb and flow anymore.

And then you look at the average American, they probably eat maybe 12 different types of foods, right? Compared to the upwards of 600 different types, because our ancestors, you know, they were hunter gatherers, foragers, you know, they ate everything and, they dug for lots of fruits and tubers, you know, they plucked stuff, they ate insects and all kinds of things.

And so we really have to help ourselves increase the diversity of our food intake. Now then we also have the, the, the the problem with that is that so many people are so sensitive to so many things.

Right? So then the the response to that sensitivities to go on elimination diets and slowly start removing huge categories of food. Yeah. Which is right.

And which is crazy when so, so fraught. I mean, there are some times when we need but in general, right? I have seen that that is the that the road to destruction so often at the time.

Again, self-protection begets more self-protection unfortunately. Exactly. And you put yourself in more and more and more of a bubble. Right. And yeah, I, I talk to endless people all the time and they say things to me like, oh, I feel fine as long as I don't eat this, this, this, this.

And they list like 40 things that they can't eat anymore, you know? And to me, that's not healing, right? You know, avoidance is not healing. Just like if you're starting to develop anxiety, one of the worst things you can do is give in to the anxiety and avoid behaviors that you feel are going to trigger your anxiety.

Right. So that that kind of avoidance is really not good for the for the microbiome. So it's about, you know, refining the system and refurbishing it to a point where you can tolerate, a more diverse set of foods.

So being able to eat, a diverse set becomes key. Now groups of foods that are, that are hugely important, I would say things like resistant starches, you know, roots and tubers.

They're so critically important because, again, we should really be focusing on feeding the large bowel bacteria and then probably the unsung heroes in the, in the, in the food world that probably do more for us than we ever recognize are polyphenols.

Polyphenols are so critically important to our functionality. And we, you know, they haven't really, to me, gotten their heyday as being super health food, meat like, I thought that berries or or just colored.

Exactly. Yeah. But berries, anything that with the with the pigment to it. Right. Yeah. That are high in carotenoids and all that stuff. And because I also see a lot of people, they're like, oh my God, I have Sibo, I can't touch any of those fruits. Right.

So and again, they're, they're scared of the sugar that's in the fruits and you know, or then go to the vegetables that are color, right. That, that give you some of those problems because but they don't quite get the same heyday as like, say, fiber does, you know, fiber.

I think most people start to recognize that, yes, we need fiber in our diet. But polyphenols are so critically important they act as prebiotics in your microbiome.

They are the precursors to a number of neurotransmitters and nutrients and all that the microbiome produces for you, including that one critical one I mentioned earlier.

You're than a year left in a is a critical compound that basically controls your cell repair and cell turnover. And we can't get it from my diet. It has to be metabolizing created in the microbiome from the digestion of polyphenols. Right.

So I cannot overstate the importance of that. Yeah. And and so when you know, you are there, you know, you said there are these keystone species that you think are important.

If we you know, how are there? You know, I know that your company makes some, some spore based probiotics and other are, are are they mostly there or, what how do you, how if you need to supplement them?

How do you recommend doing that. So the, the difficulty is most of the keystone species, you can't supplement because most of them are strict anaerobes, right?

So they can't exist outside the body. Very well. Many of them, the moment they come out of the body to defecation, for example, they die within 30s or a minute because oxygen is toxic to them.

And so really, our best shot is increasing. What is naturally already there. And I know that, you know, you can do tests sensitive as far as bio effects.

And you may find that there's no detectable level of, let's say Aquaman or for killing bacteria, it doesn't actually necessarily mean that it's not there at all.

Right. The reason for that. So if it's a part of it is a probability game. Right. So what's coming out in the stool is not homogenous, right. It's not like every single stool you have is a perfect representation of the proportion of everything in the microbiome.

Right. There's some variations in there as to what was coming out of that time. So if a certain microbe is at a really small low level in your gut, the likelihood of finding it in a in a non homogenous sample becomes lower and lower and lower right.

And so you might get your stool sample, you send it in and then the test doesn't pick up any. It doesn't mean it's not there. It means that such low levels that your probability of finding it is very small.

And so I don't want people to be discouraged and go, oh my God, I have no Aquaman here because we see this on test all the time. But then you do all the right things in the next test, you actually pick up and come here. Right?

And it's not that we've put it in, it's just that now we're giving the actor dementia the condition it requires to proliferate in the in the GI tract.

Right. And then the more the number is, the more the higher likelihood is that you'll pick it up in the tests. In a healthy gut microbiome, you can have upwards of 5% of your total microbiome as just Aquaman's.

Yeah, right. 5%. That's a huge amount. When you look at, right, 120, 130 different species making up the whole population, giving 5% prevalence of one organism.

And then on top of that, the other keystone species I talked about a lot scaling back here. Promise that I can make up 5% as well. So just almost 10% of your entire microbiome on just these two species, right?

That's how important they are to maintain health, wellness and all that. And we routinely see undetectable levels of these organisms in people's tests.

Now, if you start doing the steps that you need to do to start growing, those organisms are fasting. Getting in the polyphenols for killing bacteria in particular really likes resistant starches and fiber.

You know, taking those in, getting better exposure outside, taking the spores. We saw that the bacillus spores, we published this study actually increases the keystone species, even without a dietary change.

Right. One of the things I really love about bacilli that is so unique to them, I haven't seen this with any other genus, of microbes, is that they are regulators of the gut microbiome.

Right. So they can go into the gut microbiome, and then they can actually figure out what's growing at too high a level, what's not there enough. And then they'll bring down overgrown problematic organisms.

They'll increase the growth of beneficial organisms. We actually have have shown and published that when you add bacillus to your gut microbiome, it actually increases the diversity of the gut microbiome, okay, independent of feeding.

So it's just that organism. That's what it does. We've outsourced that job to Bacillus because we can't do it ourselves like nature did not intend this, or foresee that at some point we'd be putting concrete walls up between us and the these bacilli that are outside of the natural environment.

Right. And so through the course of symbiosis and, directed coevolution, we developed this mechanism by which we've given them the job to maintain and regulate the microbiome while we give them a happy place to live, which is in the gut.

Right. But so, so that's why we've homed in on the bacillus so much in the probiotic space, because we find that the things that they do in the gut provides all kinds of universal benefit, right?

So we've published studies on, reducing triglycerides, dramatically, reducing acne lesions dramatically. Right. Leaky gut, of course, inflammatory pathology.

We have a study finishing on rheumatoid arthritis. All of those seemingly unrelated conditions, right. Acne, triglycerides, rheumatoid arthritis, all on the same, formulation.

Right. And the reason for that, it's not that it's some sort of magic pill and it does everything. It's just that when you start to support the fundamentals of the gut microbiome, you start to see all of these benefits across the board.

That's amazing. I mean, and that's the kind of information we all need because we're struggling. You know, we we we know how hard we try. We do live in a concrete world.

I mean, except the few of us who are lucky to, you know, have gone back to nature. The rest of us live a pretty, sterile environment compared to where we should be in.

And it's a amazing turn of events now, and I just hope that, you know, we all learn that it's the interconnectedness that's important in every day. Yeah.

So I have to, I kind of wrap up, but I just this has been an amazing conversation and, hope that we'll come back again and go into more detail about what we can do and how we can supplement and support our, our internal environment.

Yeah. So thank you so much. It's a pleasure. And just reminding people that it's, you know, Microbiome Labs and, and biome ethics I said is, is a test worth doing and working with your practitioner on that you can just begin.

It's just one other window into what's going on. Remember that. Don't don't get hung up if it doesn't look so good. It it's organic. It can grow and change it can. Yeah.

It's a it's an ecosystem. Right. So it's all about the inputs. When you put it in what you put in the system will affect the system dramatically. So this, the biome effects gives you an opportunity to understand what inputs are best for, for your microbiome.

But yeah, thank you so much I appreciate the opportunity. It's always great to be able to talk microbiome science. And, hopefully somebody learned something from it.

And they'll make a change. And that change will will improve their lives. So I appreciate yeah. No it's working towards health and balance as you say resilience because that's really what health is all about.

So thank you again. Thank you. Well. For.