Mike Roesslein (00:09):

Hey everyone. Welcome to the microbiome series, version 2.0. We are back with a whole new series, upgraded, bigger, better, more organized, and it'll be fun. So Kiran, thanks for coming back and talking to us.

Kiran Krishnan (00:31):

Yeah, thanks for having me. Happy to be here. Always.

Mike Roesslein (00:34):

For everyone who didn't watch the original 12 to 13, I lost track of how many we did, webinars for microbiome series and doesn't know you very well, can you just tell the audience a little bit about yourself and your background, so they know who they're listening to?

Kiran Krishnan (00:51):

Yeah, sure. So my name is Kiran Krishnan. I've been in the nutritional dietary supplement medical food industry for about 17, 18 years now. I've mostly focused on product development for other companies, like helping other companies develop products. Also, doing a lot of clinical research. I've done dozens and dozens of clinical trials. I actually owned a clinical research organization for a long time where companies would hire me to do clinical studies on their product. Over the last about ten, 15 years I've been really focused on the microbiome and probiotics and understanding the microbiome, studying the microbiome, and then developing products that should support the microbiome. Also been doing a lot of lectures. So this year we just tallied it up, we've done 54 conferences so far this year.

Mike Roesslein (01:38):

Wow.

Kiran Krishnan (01:39):

So it's insane. It's more than one a week. And I think I've spoken at 50 out of the 54 and so a lot of speaking, a lot of education, it's a good place to be right now because the microbiome is so hot and things are changing every single day. So that's what I do.

Mike Roesslein (01:59):

Yeah, man. I think we almost crossed paths in London a couple weeks ago and then almost again in California last week. We need like an app that you can bring up that says, 'where in the world is Kiran.'

Kiran Krishnan (02:10):

Yeah exactly. 106 [crosstalk 00:02:13].

Mike Roesslein (02:13):

Put a little beacon on you.

Kiran Krishnan (02:14):

Yeah, totally.

Mike Roesslein (02:15):

160,000 miles you've done this year.

Kiran Krishnan (02:17):

Flown, just this year alone, it's crazy.

Mike Roesslein (02:20):

Wow, hopefully you've got a good frequent flier program.

Kiran Krishnan (02:23):

I do. I'm racking them up.

Mike Roesslein (02:25):

All right. Cool, well we've used the word microbiome about a dozen times already, so maybe we should backtrack a little bit. What is meant by microbiome, so that if somebody's totally new to this concept, and they're starting here, what does that even mean?

Kiran Krishnan (02:42):

Okay, so let's distinguish a couple terms. So you might hear the term flora. The term flora basically talks about the microbial environment. So all the different types of microbes. That includes things like amoebas and parasites and viruses, anything living in one ecology is called a flora. Another term for flora is microbiota. And you'll microbiota as well, but that refers to just the organisms themselves. Microbiome is a bigger term and it's all encompassing term because it includes the organisms, but also all of their genetic elements. So all of the organisms DNA and how that DNA and the organisms themselves interact with the host. The other thing it includes is also all the metabolic things that these organisms produce.

(03:33):

Cause one of the things that we really are starting to understand is that, the organisms that live in and on our body produce the vast majority of the metabolites and compounds that we need to conduct our biological function and they do that using their DNA. We share some of the DNA with them. Meaning we actually utilize their DNA to create proteins. So just looking at the organisms themselves is not a complete picture, the real full picture is the term microbiome, which looks at the genetic elements and also all the metabolites that they produce.

Mike Roesslein (04:07):

So we use their DNA?

Kiran Krishnan (04:09):

Isn't that crazy? Yeah we actually use microbial DNA for our own functions. So just to give you a method of comparison and analysis, we've got about 22,000 genes in our chromosomes, right as human beings, and we're very sophisticated micro cellular organisms meaning we're at the top of the food chain, we're at the top of evolutionary ladder, we can do things no other mammals or animals can. But we have less genetic material in our chromosomes than a rice plant does, or an earth worm. So we ...

Mike Roesslein (04:42):

Didn't they ... Wasn't that surprising when they ran ... Isn't there a ... What was that called, human genome project. Didn't they expect to find way more genes than they did, and they thought at first that maybe they even did it wrong or that this couldn't be the answer?

Kiran Krishnan (04:55):

Exactly. What they found was that ... So before they sequenced the whole human genome they estimated that we would have somewhere around 130, 140,000 genes at minimum, because of all of the biological functions that we conduct in our body, right. And then they ran the first sequencing and then they saw somewhere around, if I'm not mistaken around 30,000 and they thought that, "Wow something, we totally screwed up because this does not explain all of the things we can do." And there's a lot of junk in our DNA. Our DNA has a lot of white noise in between actual genes that code for something specific. Now, since then we've actually trickled it down to about 22,000 genes. Some latest estimates actually go down to about 19,000. So we're finding out that we have less and less information in our DNA that we require then we previously thought and it does not explain how we conduct all these other functions.

(05:51):

So then here comes along the human microbiome project, this is the follow up to the human genome project, what we find is, we have over three and a half million microbial genes in our body. So compare that to 19 to 22,000 ...

Mike Roesslein (06:06):

Three and a half million?

Kiran Krishnan (06:07):

Three and a half million and that's a low estimate. That number's actually going up slowly. But we now know that we have at least 150 to 200 times more microbial DNA in our body that we use, then human DNA. In fact some of the latest estimates say that we use about 99% of our metabolic function we do every single day in order to function as human beings, breathe, to walk around, metabolize food, all of that stuff, we use microbial DNA to do those things. 99% of what makes us, us comes from microbial DNA.

Mike Roesslein (06:47):

So if those went away, if all of those organisms disappeared we'd cease to function, essentially?

Kiran Krishnan (06:51):

We would cease to function. We'd be a shell, essentially. Cause we actually think of ourselves as a shell, as a vehicle for these organisms and they control the vehicle in many different ways. So when we're thinking about bacterial therapy, when we're thinking about using probiotics or thinking about our lifestyle in general, if we don't account for what that lifestyle of those therapies do to the DNA of the microorganisms in our gut, the distribution of that DNA, then we're really ignoring 99% of ourselves. And the vast majority of people and doctors and all that don't think about that 99%. So all these years we're trying to heal disease, we're trying to make people better, we're trying to improve and get wellness and all that, and we're working on just 1% of ourselves. We're not considering the other 99%

and that's a huge flaw and fortunately that flaw is now starting to become corrected because of all the microbiome work.

Mike Roesslein (07:54):

That's crazy. I think I hear brains exploding all over the world, right now. So these three or these millions of DNA come from billions of organisms. Where are these organisms found exactly on or in the body? I mean I can't see them.

Kiran Krishnan (08:07):

Yeah, so that's actually, you can smell them. Sort of.

Mike Roesslein (08:11):

That's true.

Kiran Krishnan (08:11):

If you don't take a shower for a couple days.

Mike Roesslein (08:14):

I just took a shower so I can't smell them, right now.

Kiran Krishnan (08:16):

Oh you did, okay. But everybody's got their own unique scent, right? If we just let our bodies go, we don't cover it up with perfumes and scented soaps and all that, what you notice is that everybody's got their own unique smell to them. In many cases that smell is attractive to some people, in many cases it's repelling. And that smell alone comes from the microbes in your body and on your skin. So let's talk about where all you find the microbes. And this is something that has been really surprising to the medical community because we used to think that there were many parts of our body that were completely sterile, right.

(08:53):

We used to think that urine is sterile, we used to think our blood is sterile, we used to think that the urinary tract is sterile, we used to think that the heart is sterile, or the eyes are sterile, all these areas that we thought, there really aren't any microbes and that would be a problem if microbes existed there, we now come to find out not only are they not sterile, but they have critical microbes that allow for the functionality of those systems. So let's take the female urinary microbiome. There's something called the FUM. F-U-M. And there's a whole area of study now just on the urinary microbiome. So we used to think that our urinary tract was sterile and if there were bacteria in there we'd be in danger because we'd be increasing our risk for urinary tract infections, but what we come to find out is that there's certain set of microbes that actually live and function within the female urinary microbiome. And those microbes control things like the fertility levels of the female, the ability to carry and harbor a pregnancy, the success rate of the pregnancy, the health of the baby.

(09:59):

All of these things, the menstrual cycling, the hormone balancing, all of these things are controlled by a small subset of microbes that live in the female urinary micro crack. So it's really fascinating to think, that not only is it not sterile, but it has a collection of microbes that actually control the function of that

entire organ system. So we actually have bacteria everywhere in our body. There's not a place in our body that we don't have microbes and those microbes in those locations actually perform really important functions in order for those locations to actually do the job they're supposed to do.

(10:39):

We're doing some work on the eye biome. So the E-Y-E, not I, as in iPhone, but the microbiome of the eye and there's some good preliminary evidence that we all have a unique microbiome in our eye and the type of microbiome we have in our eye controls things like, cataract formation, glaucoma, other things like redness of the eye, and dryness and things like that. So it's really fascinating that the microbes control virtually everything. So think about your skin, your genetal tract, your gut, your mouth, your hair, your nails, everything have microbes within them. And then inside your body every organ system has microbes and we're starting to see that each organ system may have their own unique set of microbes, that help that organ function.

Mike Roesslein (11:28):

So we're just like a car that the microbes drive?

Kiran Krishnan (11:32):

Exactly. We're a collection. So there's a great term for most people, if they have time to look this up, called a holo-biome. Holo-biome is H-O-L-O-B-I-O-M-E. And basically what that means is a super organism. So we have to stop thinking of ourselves as these species. As homo-sapient, sapient, species that has evolved to become this top of the food chain, amazing mammal. What we really are is an ecology. We're like a walking, talking rain forest. We are a super organism made up of thousands and thousands of smaller ecologies that all communicate with one other, work in concert in order to propagate the health of the entire ecology. If we mess up even one part of that ecology, it can screw up all of the communication. That's why if you mess up part of the gut, if you mess up part of your skin, if you mess up a single organ, if you do something like take too many baths with anti-microbial soaps, small things like that can totally screw up the entire organism, over time because we count on those communications and that orchestration of synergy between all the different parts of our body.

(12:46):

So we can't think of our hand as being independent from our foot or our lungs being independent from our liver, all of these things are connected through our microbiome network.

Mike Roesslein (12:57):

We'll touch a little bit more in a minute on how they get disrupted, but how do these things all get there? How do these organisms get to where they are? In the gut, in the body, how is our microbiome populated? Are we born with it? Do we acquire it later? Do I just have to eat more yogurt?

Kiran Krishnan (13:13):

Yeah. That's a great question. So in utero itself, so when we're in mom's womb, we actually start getting some level of inoculation in utero itself. Basically one of the things that happens is mom's immune cells actually have the capability of going and grabbing some of her microbes and putting it though the umbilical cord and inoculating the baby, the fetus, that's in the womb. And that inoculation starts the process of getting the microbes situated on the fetus itself. The other part of it is mom's vaginal tract and the birth canal, that's a huge area of inoculation for the soon to be born baby. And one of the things that happens is, the vaginal microbiome starts to shift as a mom progresses during pregnancy. So to give

you an example, the vast majority of bacteria within the vaginal tract of a non-pregnant women are different species of lactobacilli like lactobacillus crisp actus, which is really prevalent and actually is a indication of a good healthy vaginal microbiome, but what happens is by the second trimester of pregnancy, the predominant species starts to become lactobacillus jonsi. Lactobacillus jonsi is not typically found in high prevalence in the vaginal tract of a non-pregnant woman because the function of jonsi is to break down milk. And most women I know aren't digesting milk down there when they're not pregnant, right.

(14:40):

And so you don't really need a lot of lactobacilli jonsi, but once a woman becomes pregnant and by the second trimester the microbiome of her vaginal canal starts to shift to favor a better inoculum for the baby. And the baby needs that lactobacillus jonsi cause the first thing the baby's gonna get is col lustrum and milk from the mom and the baby needs to be able to break that down and digest it. The baby's not producing any enzymes so it requires that presence of that bacterial strain in order to break down the milk. So mom's vaginal microbiome starts to change, it starts being set up for welcoming the baby and then when the water breaks, and the water is a significant thing as well, because when the water breaks it helps to detach a lot of those microbes from the vaginal surface and makes them more available to get on the baby itself. So it's like bathing the baby in a microbial shower, if you will.

(15:36):

So then once the baby passes through the birth canal it gets full inoculum of all of mom's vaginal bacteria. There's a whole different, a whole bunch of different bacteria within mom's vaginal tract and then when you pull a baby out, if you measure a babies, say their skin, their nose, their mouth, their [inaudible 00:15:53] tracts, first couple hours of birth, they all match mom's vaginal bacteria. And then if you keep measuring it over the next few months, at six months, at eight months, at ten months, what you start to see is that the babies skin bacteria starts matching mom's skin bacteria. No more does it look like mom's vaginal bacteria. So the vaginal bacteria then specialize in different tissue, bodies parts. And this part is called a succession part.

(16:20):

So we've got an initial inoculum of a whole bunch of bacteria passing through the birth canal and then as soon as we come out we get exposed to the outside environment, we get exposed to dad, we get exposed to things at the hospital, in you're born in the hospital. And then over the first year, you appear in succession where different bacteria specialize in different types of tissue so that you get a unique skin bacteria, you get unique eye bacteria, you get unique nose bacteria, unique mouth, vaginal, gut, everything starts to specialize and you end up with a specialized set of bacteria within each of those parts.

Mike Roesslein (16:54):

Wow, that's crazy. And all of that's just happening.

Kiran Krishnan (16:57):

It's just happening and it's like this crazy fluctuating, changing ecology. And it matches what's happening with the baby that you can actually predict. So for example, the first six months of the baby's life it doesn't really produce any immune cells the way an adult does, right. So the baby doesn't really have its own immune system. So it becomes really important for the baby to nurse, and get breast milk because breast milk contains all these great immune factors. Not only that, but it also contains 6 to 800 different species of microbes. So breast milk is loaded with microbes. And then it also contains over 200 different

prebiotic allegal sacrids that the baby can't even digest for food, it's there strictly to help seed the bacteria. So as the baby's microbiome starts to change when they hit six months, seven months, eight months, you start to see improved functionality in their immune system.

(17:54):

They start having their own ability to defend themselves against viral infections, environmental toxins, things like that. They also start to be able to digest food. You can't give a newborn solid foods, they would not be able to handle it, but the reason you can give a six, seven, eight month old solid foods is because they're starting to develop the right type of microbiome within the gut that can break down the food for them. Even things like walking can be an indication of the types of microbes baby has. Babies that take a long time to start walking have different types of microbes in their guy then babies that walk sooner, because the microbes within the guy actually control motor functions as well. So everything is dependent on the succession of the microbies and the specialization of these microbes within the different body tissues.

Mike Roesslein (18:44):

Wow. So as complex as all of that is and developing and it just happens and we don't have anything to do with it, if we just leave it alone it generally develops pretty well and balanced and ... But we found ways to make it not happen, very well, and to kind of prevent the ... Some because we didn't understand, some because we mistakenly blame bacteria for everything that's wrong in the world, so we need to kill them all. How does this go awry from birth, like things when we're born, when we're little all the way to, maybe an adult could have a pretty good development up till adult age and then something happens and throws it out of wack. In our modern, western, civilized, industrial world or whatever you want to call it, what have we done that has disrupted these paths of development and ultimately the results of the development or damage to the microorganisms?

Kiran Krishnan (19:40):

Yeah and that's such an important question cause that's really what is driving the prevalence of disease and chronic illness in this world, especially in the western world, is the impact that we have on our local environment and how that impact has, or how that impacts our natural environment, which is our ecology. So to give you a really good example, one of the cleanest places in our terminology of clean, in the modern world, is a hospital, right. A hospital is said to be sterile and clean cause they're always disinfecting it, all of that stuff. Now a hospital is also the most dangerous place. That's a place where you pick up things like CDIF, you pick up things like methicillin resistance astrophorous, mersa, you pick up things like ampicillin resistant bacteria, you pick up pneumonia, you get all of these things. You get all of these things, these all called nosocomial infections, that's a fancy word for opportunistic infections you get at a hospital.

(20:41):

Hospitals are the most dangerous place to be and the reason is because they're so sterile. So we have undone the beautiful balance that nature's created between pathogenic and potentially harmful organisms and the vast majority of organisms, which are good for you. And like you said, we've developed this negative view of bacteria, but what we have to understand is bacteria gives us life. Without bacteria, we can not exist today. And the vast majority of bacteria are good. There's a few bacteria that actually cause disease and those few bacteria actually will cause disease in the absence of the good bacteria. So that's really where we've screwed up, is we have taken the natural world and

we've tried to engineer it in a way that we thought was best, and that's why we develop things like chemical cleaners and ...

(21:36):

I just saw a company's releasing a paint on the wall, I can't remember, it's Sherwin Williams or one of those big paint companies, it's an anti-microbial paint. And I'm thinking to myself, when was the last time somebody suffered a disease because they rubbed up against a wall in their house? What in the world do we need anti-microbial paint for? It's the stupidest thing and I hope nobody buys that because it's absolutely ridiculous. And it's just like this crazy marketing thing like, "Hey we have another way of killing bacteria." Well we're killing things that are giving us life. So the things that we do on a regular basis that happens to us that really destroys the ecology of the microbes, are antibiotics to begin with. And I don't want to just knock antibiotics blatantly, but antibiotics can save lives as well and they have their place. They're absolutely necessary. If I was septic right now, for some reason, I wouldn't be taking oregano oil. I would be going to the emergency room and saying, "Hey pump my iv, give me iv antibiotics so I don't die."

(22:40):

Or if I had [inaudible 00:22:41] or something like that. But, the casual use of antibiotics, especially for things that aren't even bacterial infections, a lot of times they're used for viral infections just to appease people, just cause people force the physicians into doing it, or the physicians just say, "You know what, just take an antibiotic." Cause they don't really understand the damage of it. We're right now involved in some work and there's some work going on in London that shows that a single dose of Augment in, which is a powerful antibiotic that people use for sinus infections and things like that, a 600 milligram does of Augment in, which is a regular dose, reduces your microbiome in your gut by 90%.

Mike Roesslein (23:22):

Holy, cow.

Kiran Krishnan (23:23):

90% of the microbes get wiped out with that one dose, right. Now, here's what's crazy about it, they will bounce back. The microbes will come back and they'll come back very quickly. The problem is, the proportion of the microbes coming back is gonna be different. That's what screws everything up, right.

Mike Roesslein (23:40):

It's like a race to fill the space and whichever ones can grow the fastest will be the higher populated.

Kiran Krishnan (23:47):

And keep in mind it's whichever ones can grow the fastest in this new environment. So here's what your guy is like, and this is to really over simplify it, right, most of the good bacteria within your gut are lactaid acid producing bacteria. So they keep the gut, for the most part, fairly acidified and there are parts of the gut that are higher in PH, around six, closer to seven, but for the most part the gut is leaning a little bit more acidic than neutral or basic. What happens is, when you wipe out 90% of the microbes in your guy, the PH of your gut goes way up because now you don't have all these microbes that are producing lactaid acid anymore. So in a new environment where the PH is up, there are certain types of bacteria that grow better in that higher PH and those are the things like clostridia, ecoli, acrocephalous, all these things that you don't want to come back in higher prevalence, now all of sudden the environment is better suited for them.

(24:43):

That's why a few rounds of these types of antibiotics, you totally screw up the proportion of the good to the bad bacteria. And then there was another study that showed a single seven day course of Clindamycin at 300 milligrams a day took your body a year to recover from. Just to establish normal function again because the microbial environment is so screwed up at this point, right. So antibiotics is one. The other thing is, antibiotics, antimicrobial soaps both for hand soaps, body soaps, people are trying to kill bacteria all day long off of their systems and that's one of the worst things you can do. The health of your skin is highly dependent on the having the right types of microbes on it.

(25:28):

And even your ability to perspire properly, to get rid of opportunistic infections and all that is dependent on the types of microbes you have on your skin. If you're using antimicrobial compounds every single day what you're doing is just screwing up the balance. So imagine you're trying to grow a garden and then every day you're just going in and throwing poison in the garden and then that allows noting but the weeds to come up. The other things are, just the chemicals around us. For example, things you find in the paint in your house and the glue in your shoes, the formaldehyde. There's a lot of flame retardant chemicals in virtually everything we sit on and sleep on and lay on, those flame retardant have a huge impact on the microbiome. They kill off bacteria, they cause a lot of toxicity. There is something like 80,000 chemicals that we are surrounded by on a daily basis, none of them that I can think of, have been tested for their impact on your microbiome.

(26:31):

Less than, I think it's less than two or three percent of them have been tested for toxicity in humans in general, just in whether or not their toxic to humans, but none of them have been tested for what do they do to your microbiome over time. How do they impact the super organism? And that's why I always press on people we need to keep thinking of ourselves as an ecology and what is natural for this ecology and what is unnatural for the ecology. We can't be screwing up the ecology or we screw up the function of the entire organism. So any one of those chemicals ... If you have Clorox cleaners in your house, like your goal for your house is to sanitize your house, which most people do, studies show that household that use Clorox based cleaners have kids with a much higher prevalence rate of viral infections, flu's, asthma, allergies, all of the immune dysfunctions, because they use Clorox based cleaners and we think that Clorox smell is a clean smell. It's the smell of death.

(27:29):

So you're killing yourself, you're killing your microbes. So clean your house with water. Clean your house with water and a little bit of essential oils. Or just leave your microbes alone, for the most part. That's really the best thing we can do for ourselves is just to leave our bodies alone and don't disrupt the ecology with all this chemistry.

Mike Roesslein (27:52):

That is crazy. And so leaving ourselves alone will be today's tip. We are gonna cover a lot more as far as fixes of microbiome or ways to kind of repair damage done. We're gonna have the downloadable guide that's gonna be part of this insider series and also in the other episodes cause we're just getting started. So we're gonna have, I believe, seven really concise episodes coming up that everybody that has, watching this interview has access to all those recordings, transcripts, MP3's. So we're gonna cover more about the fixes later on. Today I just wanted to get a general overview of what is the microbiome, how does it get there, what does it do, how important is it, which is, I think, there's no superlatives that

could be used. That it's pretty much everything. And then how and why it gets disrupted and this will give people a great starting point to kind of explore the rest of the information from.

(28:46):

So I think that was great. Thanks a lot Kiran, it's always a pleasure to talk to you and I always learn all sorts of mind blowing facts that explode my brain and make me second guess everything that we're doing. I don't mean us personally but, humans as a species at this point are just kind of destroying ourselves on so many levels. And the rain forest comment really struck with me because we're killing that and we are that in a lot of ways and the soil ... Jessica, our little, our ninja over at Rebel Health Tribe that packages and ships all our orders and does all our correspondence, she teaches at the University of Richmond, actually on soil science. And she runs CSA's and does a lot of sustainable biodynamic permaculture type farming and explain that just like you compared the human body to a rain forest, it can also be compared to soil. And that as we kill the soil in the rainforest we're also seeing ourselves [inaudible 00:29:47] that that's not a coincidence.

Kiran Krishnan (29:48):

Absolutely. Yeah and people really do not understand our connection to the earth around us, right. And we think of that as like this metaphysical, hippie kind of thing, like oh mother earth we should cherish her and all that. That's fine and dandy, going beyond that, just looking at that biology of it, the importance of pristine, natural dirt for our health is enormous. There's a ton of studies that show that cultures and people that are more exposed to natural dirt actually are far healthier than people that live in these modern urban concrete jungles.

Mike Roesslein (30:28):

Even with all of our medicines and conveniences.

Kiran Krishnan (30:30):

Exactly, yeah, all our technology, all of these things. The most important thing for us is just being closer to nature and not screwing up nature. So the whole political ramifications of the environmental science, put all that aside, what we know is we evolved in a certain type of environment for the three to four million years that human evolution existed and we became who we are, now we're totally changing that environment that we don't belong in anymore. And that screws us up down to the cellular level. And how that impacts the microbiome really is where I try to specialize in and then of course what can we do to try to undo some of what we're screwing up every single day. And that's really the crux of it.

(31:20):

I always go back to, in order to fix ourselves, we have to fix the super organism. We can't fix a single system in our body. We can't fix just our gut, we can't fix just our liver, we can't think, oh I need to support my liver or I need to work on my adrenals. Everything is connected. We gotta put the body back in balance and the first part of that balance is how do we get the microbes back in balance cause that's the first thing we've done is screwed up our microbes. And we gotta get them back in balance before anything else can heal.

Mike Roesslein (31:54):

Makes sense and we will talk a lot more about that in the upcoming episodes and in the guide and everything else. Kiran, thank you so much again for joining us. As always it's much appreciated and we always learn tons of awesome stuff. I'm gonna go digest this a little bit and we'll ...

Kiran Krishnan (32:09):

Your microbes will help you digest it.

Mike Roesslein (32:12):

My microbes will help me digest it and we've got ... Today we're recording this, I don't know when people are gonna watch it first, but one week from today, I think we have our first, we're recording the first episode of the new microbiome series, so looking forward to that also and it's gonna be a lot of fun. And thanks and have a great day.

Kiran Krishnan (32:29):

Thanks, bye guys.